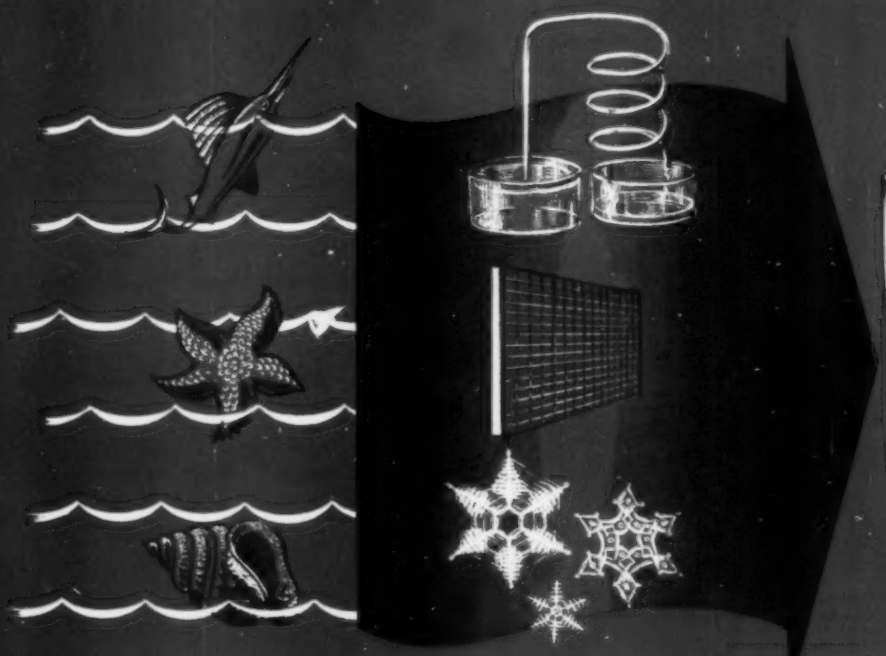
OCTOBER 7, 1957 PRICE 50 CENTS

Research and Development Edition

Product Engineering

McGRAW-HILL MAGAZINE OF DESIGN RESEARCH AND DEVELOPMENT



SALT WATER TO FRESH

New solutions to an old problem...
see page 23

The Industrial Designer... FRIEND or FOE?
see page 28

Select your new product with care... *see page 30*

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Other uses range from carrying chemicals in filtration plants to serving as underground conduits for electric cables. In fact, in almost every application where rust and corrosion threaten metal pipe—from within or without—Kralastic pipe is fast replacing it.

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October 7, 1957 Vol. 28, No. 13

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Product Engineering ..... SIDELIGHTS

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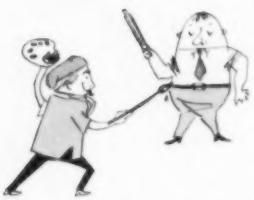

● **The artist** has so little in common with the engineer that it is not surprising to find considerable conflict when their work overlaps (see p. 28). We've seen technical editors sputter helplessly after their first contact with an art director, yet (oddly enough) these same men gurgle and crow at the appearance of the published article. Let's face it, dress up anybody's baby in attractive clothes and his father gets the credit—not the fashion designer.

● **Industry consumes** 246 billion gallons of water per day, according to the Milwaukee Company, Midwest underwriters. Representative figures are startling: 7 to 10 gal to produce 1 gal of gasoline; 2,200 gal for one steer in a packing house; 50,000 gal for 1 ton of paper; 65,000 gal for 1 ton of finished steel; 600,000 gal for 1 ton of synthetic rubber. The government is considering new and more economical methods of water purification (see page 23) to meet the growing demand.

● **FYI (personal)** and Why Don't They R&D? (see pages 49 and 50) are written by different editors—one optimistic (and female), the other pessimistic (and male). This week our pessimist was ranting about cigaret lighters. "The flint-spark principle is a bit prehistoric," he wrote sarcastically, "and a nuisance besides." He has been remarkably subdued (a major accomplishment) since reading the short item in FYI this week. Firemaking is now electronic.

● **A scholarly paper** in a recent issue of the *Journal of Applied Physics* had some interesting news for harried housewives. It seems that when tea is poured from a teapot it often runs along the underside of the spout rather than into the cup. This tendency is not caused by surface tension or adhesion as many (including us) have supposed. Dignified by the name "teapot effect," certain exact solutions of hydronamic equations offer another explanation (much too deep for us). We respectfully submit that while editors rarely drink tea, cream pitchers are also serious offenders of clean tablecloths, and a dab of butter under the lip will solve the problem neatly and without recourse to differential calculus.

ABP OCTOBER 7, 1957 **Product Engineering** *A McGRAW-HILL PUBLICATION* Vol. 28, No. 13 ABC

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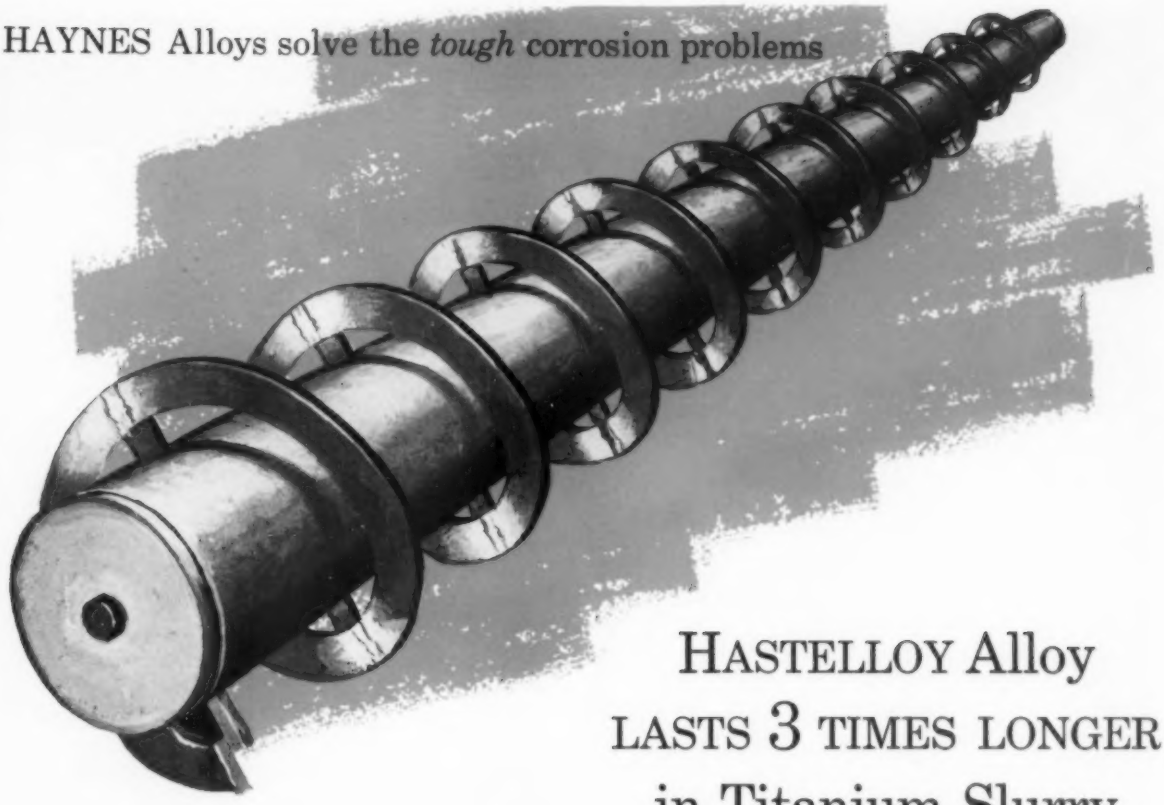
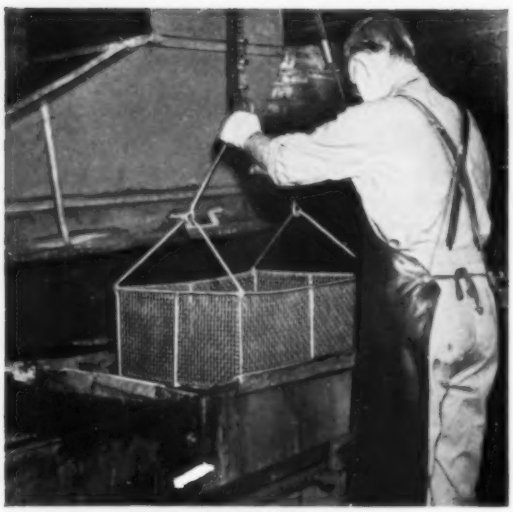
HAYNES Alloys solve the *tough* corrosion problems



HASTELLOY Alloy LASTS 3 TIMES LONGER in Titanium Slurry



Six Years in HCl at 140 deg. F. is another example of how HASTELLOY alloys are solving Metalworking's corrosion problems. This pickling tank outlasted previously used materials by 4 to 1.

Feed screws made of HASTELLOY alloy B last from 5 to 6 years while moving titanium slurry into kilns. This is three times longer than the service life of feed screws made of other alloys and used under the same severely corrosive conditions.

Handling titanium slurry is just another example of the many uses of HAYNES corrosion-resistant alloys. These nickel-base materials also have unusual resistance to the hot mineral acids, strongly oxidizing salts, and powerful gaseous oxidants. For full details, write for descriptive literature. Address Haynes Stellite Company, Division of Union Carbide Corporation, General Offices and Works, Kokomo, Indiana.

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American...

DEVELOPMENTS TO WATCH...

New angles on irradiation . . .

. . . point to custom-tailored materials. Recent work at Mellon Institute, for instance, shows that tiny amounts of aluminum in crystalline quartz greatly increase the likelihood of color changes during irradiation. Contaminants seem also to affect the properties of glassy silica. This opens up the possibility of promoting radiation changes in materials by adding impurities to them; or, conversely, to desensitize materials by removing impurities from them.

At the same time, General Electric reports that substantially large amounts of carbon black can be incorporated in polyethylene if the plastic is irradiated—giving it new electrical properties and better resistance to sunlight. And textile engineers find that irradiation can increase the pickup of dyes by cotton and other fibers. This, too, opens up new horizons in materials engineering.

The study of controled radiation changes is new—but promising; it may not only lead to improved materials but also, by increasing radiation sensitivity, reduce the amount of irradiation necessary to accomplish a desired result.

An old "miracle finish". . .

. . . is getting a push from research, and a host of new coatings for wood and metal, improved electrical insulation, and new cements are on the way. Shellac importers and manufacturers, well aware of the competition from synthetics, and still smarting from losing the phonograph-record market, are stepping up development efforts. They're introducing coatings for aluminum foil, pigmented primer-sealers for metal and wood, opaque colored enamels, and improved Flexographic inks. And they're pointing up shellac's advantages: Coatings are fast-drying and ductile, resist paint and lacquer solvents, and won't darken with age. Proof of their success in finding new markets is the remarkably stable lac consumption of recent years. There is good news on prices, too—they're down.

A big market for electronic telemetering . . .

. . . and control equipment may be coming round the bend. The railroads are talking electrification again—and this time in terms of 60-cycle power, which might well reduce construction, generation, transmission, and operating costs to a point at which electrification would be economically practical again. If and when the new boom comes, it will mean a sizeable demand for high-power rectifiers, remote-control and monitoring equipment of many kinds, and new electronic communications systems.

There's plenty of room for electrification. Less than 5% of the nation's trackage is now electrified.

More aircraft influence . . .

. . . rather than less, in future automotive styling is predicted by Chrysler Corp.'s Virgil M. Exner. The upswept fins on 1957 models, he says, improved road-holding stability and reduced steering correction by as much as 20% in strong crosswinds.

So Chrysler commissioned Carrozzieria Ghia of Italy to build a car whose shape "would create the least possible air disturbance." Result: the ground-hugging Dart, a rear view of which is shown here. Now, further extension of this idea is planned. The bird-in-flight body design, far from having reached its peak, Exner believes, is only starting its ascent.

High-finned Dart tests Chrysler ideas in "aero-dynamic" styling. This experimental car was built in Italy.

American...

(continued)

DEVELOPMENTS TO WATCH...

New ways to indicate and control liquid level . . .

. . . are popping up fast. For remote monitoring of boiler feed, processing liquids, and the like, a wide range of radioisotope and ultrasonic units is being devised. There are new electrical components, too.

One of the most interesting isotope units is a liquid-level switch for control of critical fuel levels in aircraft and missiles. For a unit designed by Robertshaw-Fulton's Aeronautical Division, an isotope source is mounted at the base of the fuel container, with a Geiger-Mueller detector above it. When no liquid is present, beta rays from the source reach the detector which, in turn, signals a warning light through a transistorized circuit. Or it can be made to turn on valves and servo motors to start the liquid flowing. But when the tank is full, the fuel itself absorbs the radiation, and no signal is received by the switch. Advantages, according to RF: light weight, reliability under extreme conditions, minimum explosion hazard, among others.

Ultrasonic liquid-level detectors work on a similar principle: absorption of high-frequency sound waves by the material being monitored. These, too, are light in weight, and are designed to operate at temperatures from minus 400 F to plus 250 F.

Among the electrical components is an electrode said to stand pressures up to 10,000 psi and temperatures to 700 F—to meet the demands of new high-temperature, high-pressure processing equipment that must handle corrosive liquids. It has been developed by Auburn Spark Plug Co., Auburn, N. Y. Similar in appearance to a sparkplug, it features a new glass-center electrode seal, stainless steel shell, and alumina insulator. In tests it has withstood pressures as high as 15,000 psi, and is believed to be "the only electrode available to operate at such pressures."

Powder-metallurgy parts . . .

. . . up to 12 in long, with a density as high as 94% of the theoretical limit, can be produced by a new and remarkably simple technique developed by H. H. Hausner, vice-president of the Nuclear Engineering Div. of Penn-Texas Corp. The technique is actually a variation of the slip-casting method used many years in the ceramics industry. No press is required; yet even the "green" compact is strong and easy to handle.

There are, of course, several tricks to successful adaptation of slip-casting to powder metallurgy. One of the most important is control of the pH of the slip—the powder-metal slurry. The particle size distribution, slip's viscosity and the type of deflocculant used are also important. But control of variables like these is certainly a lot simpler—and less expensive—than obtaining a press of the size needed to produce big parts by conventional methods. Research on the process is continuing, under AEC contract.

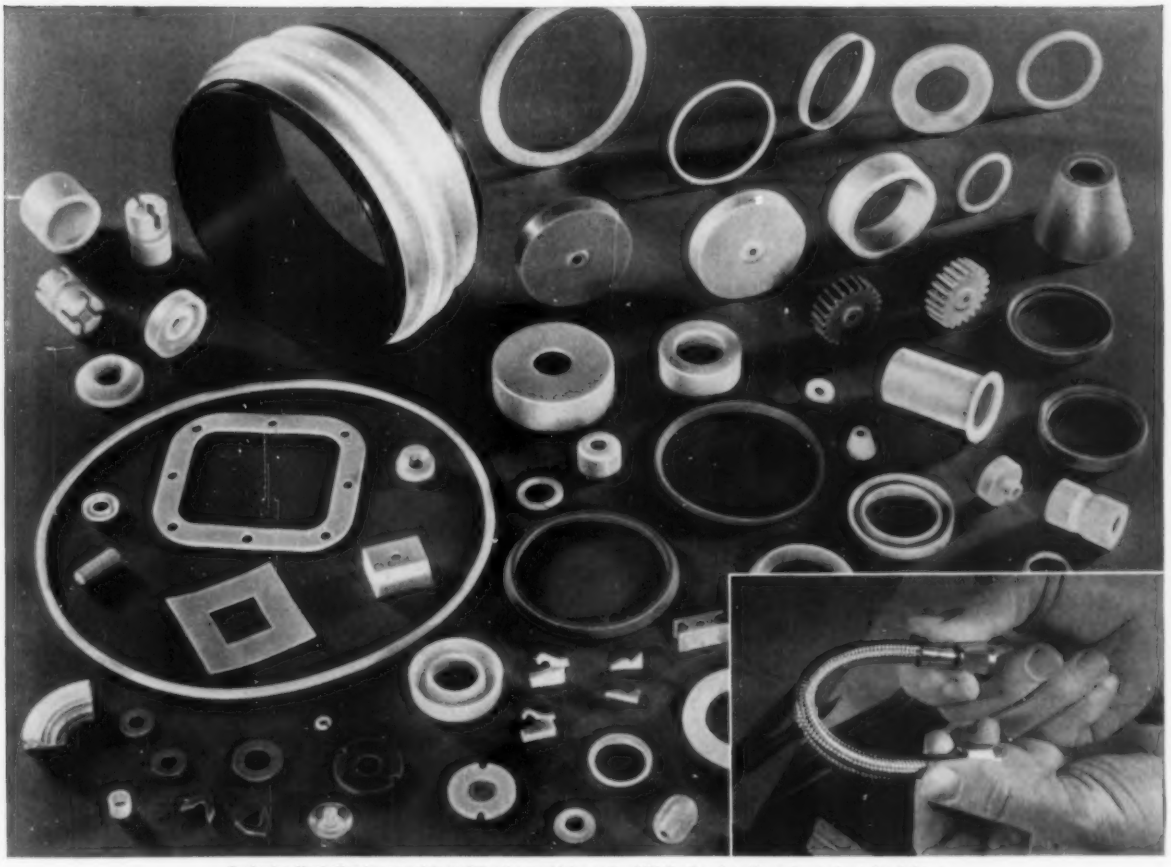
Mechanical pitch change for big propellers . . .

. . . now appears practical, based on research by Curtiss-Wright Corp.'s Propeller Division. Larger sizes of propellers have been changed in pitch by electrical, hydraulic, or electronic means. But a mechanical device should be less costly, and be able to handle changes from full-forward to full-reverse. Reliability of prototypes is said to be high, and the design quite compact.

Plastic film for electrical insulation . . .

. . . Is being made from a new Teflon fluorocarbon resin expected to have an operating range to 400 F. It won't be available in quantity until 1959, and won't be cheap (DuPont says price of this Teflon 100-X film will be "considerably higher than that of Mylar", and Mylar costs $2 to $4 a lb); but the new film is expected to have real advantages for printed circuits and for lining equipment where heat and corrosion resistance are important.

Teflon 100-X should prove attractive for extruded insulation as well. DuPont says it has a melt viscosity low enough to permit extrusion on standard equipment, and electrical, chemical and thermal properties that "will allow considerable weight and space savings. Expected applications: electronic hookup wire, jackets for multiconductor cables, and linings and barriers for aircraft fuel cells and insulators for mechanical components. A.R.G.



Raybestos-Manhattan has complete facilities for machining parts of "Teflon" such as those shown above. Inset shows R/M Flexible Thin-Wall "Teflon" Hose, which is available with wire-braided or rubber cover, with or without couplings.

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R/M has had years of experience in molding, machining and extruding "Teflon." We have a complete line of standard R/M "Teflon" products—and we are fully equipped to manufacture parts of R/M "Teflon" to your specifications. Call on our engineers for assistance with any problem you think "Teflon" might solve—or write for free literature and information today.

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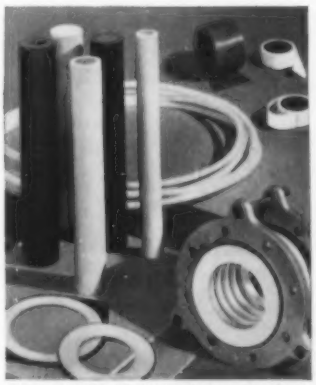

Other R/M "Teflon" Products: rods, sheets, tubes and tape; centerless ground rods held to very close tolerances; stress-relieved molded rods and tubes; gaskets; expansion joints and flexible couplings; bondable "Teflon"; braided metal- and rubber-covered flexible hose; and Raylon (R/M trade name for mechanical grade "Teflon" which has many of the characteristics of virgin "Teflon"). Write for complete data.

RM

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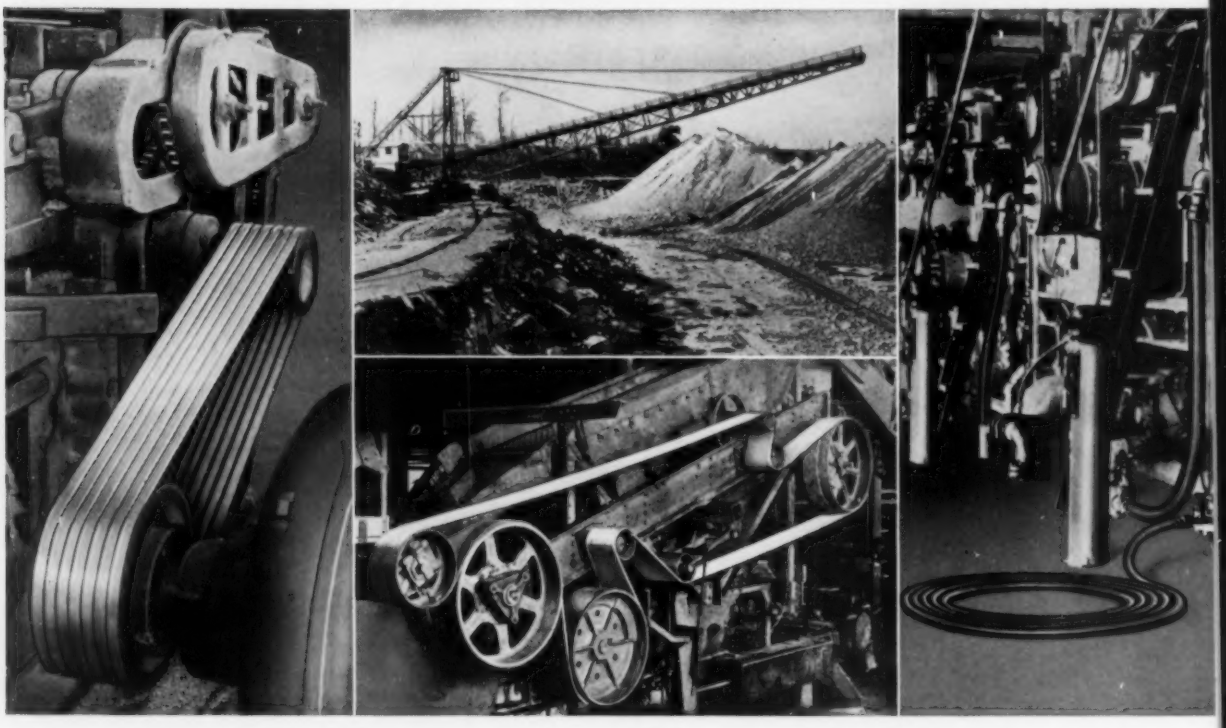

R/M RUBBER PRODUCTS IMPROVE EQUIPMENT PERFORMANCE, REDUCE COSTS

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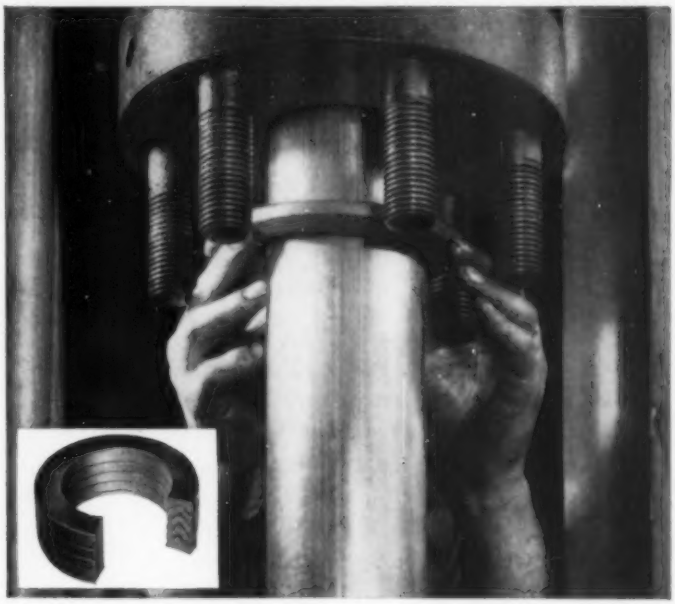

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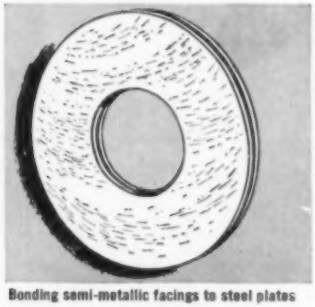
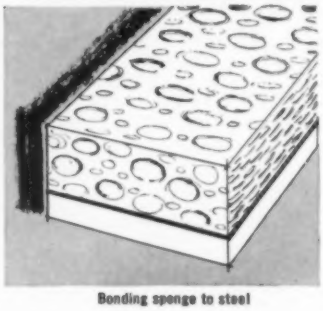
Sealing solenoid valve assembly

Bonding asbestos shim stock to vinyl plastic



Bonding semi-metallic facings to steel plates



Bonding sponge to steel

R/M Ray-BOND® ADHESIVES

simplify product design, cut costs

R/M adhesives, protective coatings, and sealers extend the horizons in the design of new products of all kinds. As in the products shown here—and in countless other applications—they bond parts together, help build stronger, more durable assemblies and, in addition, help reduce production costs.

R/M Ray-BOND adhesives, compounded of synthetic or natural rubber, resin bases of many types, and combinations of rubber and resins, have excellent bonding qualities and great resistance to heat. They are suitable for bonding diverse materials such as wood, glass, cork, plastics (including "Teflon"*), friction materials, metals and countless others. They resist temperature extremes ranging from −80°F to 700°F.

A Du Pont trademark

For booklet shown, or other data, write, wire or phone:

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R/M

Now! A Complete Line of Self-Locking Microsize UNBRAKO Socket Cap and Set Screws

Nos. 0, 1, 2 and 3 in alloy steel and stainless steel are available with the Nylok* feature

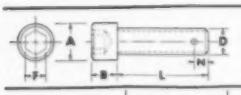
You effect major economies in time and money when you design and assemble small devices with self-locking microsize UNBRAKO socket screws. These close tolerance screws won't work loose. They simplify standardization of small devices where maximum reduction of weight is required without sacrifice of strength. They eliminate the necessity of designing costly special screws to fasten tiny parts in compact assemblies and they prevent the waste of production time while waiting for delivery of special screws.

In addition to having the overall advantages of microsize UNBRAKO socket screws, these screws can be used in holes tapped in soft or die cast materials without stripping threads and ruining expensive work. Also the set screws can be used with hardened shafts, since they lock against the threads of the tapped hole.

All UNBRAKO socket screws can be supplied with the self-locking Nylok feature. The UNBRAKO with Nylok is a single self-locking unit. No auxiliary locking devices are needed. Seated or not, the screw locks positively wherever wrenching stops, won't work loose—because the tough resilient nylon pellet forces mating threads together.

Ask your authorized industrial distributor for details today. He carries complete stocks of self-locking UNBRAKO socket screws (caps and sets from #0 through 1 in., button heads #4 through ⅝ in., flat heads from #4 through ¾ in.). Or write us for literature and samples. Unbrako Socket Screw Division, STANDARD PRESSED STEEL Co., Jenkintown 28, Pa.

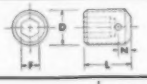
*T.M. Reg. U.S. Pat. Off., The Nylok Corporation



HEAT-TREATED ALLOY STEEL
Self-Locking Microsize UNBRAKO
Socket Cap Screws
Class 3A Threads

Screw Size		Threads per in. NC	Threads per in. NF	L Over-all Length	N Pellet Location NC	N Pellet Location NF	Torque Max. prev. on	Torque 1st off stat. min.	Torque 5th off stat. min.
#0	A .104	—	80	1/8	—	.047	5.5	14.0★	7.0★
	B .060	—	80	3/16	—	.047	5.5	14.0★	7.0★
	D .060	—	80	1/4	—	.047	5.5	14.0★	7.0★
	F .050	—	80	3/8	—	.047	5.5	14.0★	7.0★
#1	A .118	—	72	1/8	—	.047	11.0	28.0★	14.0★
	B .073	—	72	3/16	—	.047	11.0	28.0★	14.0★
	D .073	—	72	1/4	—	.047	11.0	28.0★	14.0★
	F .050	—	72	3/8	—	.047	11.0	28.0★	14.0★
#2	A .140	56	—	3/16	.063	—	24.0	3.0	1.5
	B .086	56	—	1/4	.063	—	24.0	3.0	1.5
	D .086	56	—	3/8	.063	—	24.0	3.0	1.5
	F 1/16	56	—	1/2	.063	—	24.0	3.0	1.5
#3	A .161	48	—	3/16	.063	—	40.0	6.5	3.0
	B .099	48	—	1/4	.063	—	40.0	6.5	3.0
	D .099	48	—	3/8	.063	—	40.0	6.5	3.0
	F 5/64	48	—	1/2	.063	—	40.0	6.5	3.0

★Measured in in.-gm. (those not marked with a star are measured in in.-oz.)



HEAT-TREATED ALLOY STEEL
Self-Locking Microsize UNBRAKO
Socket Set Screws
Class 3A Threads

Screw Size		Threads per in. NC	Threads per in. NF	L Over-all Length	N Pellet Location NC	N Pellet Location NF	Torque Max. prev. on	Torque 1st off stat. min.	Torque 5th off stat. min.
#0	D .060 F .028	—	80	3/32	—	.047	5.5	14.0★	7.0★
		—	80	1/8	—	.047	5.5	14.0★	7.0★
		—	80	5/32	—	.047	5.5	14.0★	7.0★
		—	80	3/16	—	.047	5.5	14.0★	7.0★
		—	80	1/4	—	.047	5.5	14.0★	7.0★
#1	D .073 F .035	—	72	1/8	—	.062	11.0	28.0★	14.0★
		—	72	5/32	—	.062	11.0	28.0★	14.0★
		—	72	3/16	—	.062	11.0	28.0★	14.0★
		—	72	1/4	—	.062	11.0	28.0★	14.0★
#2	D .086 F .035	56	—	1/8	.062	—	24.0	3.0	1.5
		56	—	5/32	.062	—	24.0	3.0	1.5
		56	—	3/16	.062	—	24.0	3.0	1.5
		56	—	1/4	.062	—	24.0	3.0	1.5
#3	D .099 F .050	48	—	5/32	.093	—	40.0	6.5	3.0
		48	—	3/16	.093	—	40.0	6.5	3.0
		48	—	1/4	.093	—	40.0	6.5	3.0

★Measured in in.-gm. (those not marked with a star are measured in in.-oz.)

Self-locking microsize UNBRAKO socket cap and set screws are available in sizes #0 through #3, in heat treated alloy steel (plated or unplated) and stainless steel, at your authorized industrial distributor. He also carries a complete stock of other self-locking UNBRAKO socket screws.

We also manufacture precision titanium fasteners. Write for free booklet.

SPS **Jenkintown • Pennsylvania**

Standard Pressed Steel Co. • The Cleveland Cap Screw Co. • Columbia Steel Equipment Co., Inc. • Cooper Precision Products • Standco Canada Ltd. Unbrako Socket Screw Co., Ltd.

American ...Washington

DEVELOPMENTS TO WATCH...

R&D Programs will be hit by the spending squeeze . . .

. . . to stay within Eisenhower's $38 billion ceiling. Latest of the "spectacular" projects killed is Navy's surface-to-surface missile Triton—after $24 million had been pumped into it.

Coming up is a complete realignment of Air Force R & D facilities, with many of them to be merged, curtailed or eliminated. Richard E. Horner, USAF Assistant Secretary for Research and Development, says the reshuffle will be completed before Jan. 1. Right now the situation is confused; no one knows what will happen. Air Force—the big spender on R & D—got $661 million for fiscal 1958, but over $300 million goes for operations and management, leaving little for new projects.

University research for the military will be cut sharply. Right now, Air Force's Office of Scientific Research has around 700 such contracts spread around the country. They're coming up for renewal monthly; but the bulk of them aren't being renewed. And when they are, conditions hamstring operations.

A major side effect, is that private research will fall off. Companies will be less likely to pump money into developing military-type equipment on the chance it can be sold to the Pentagon.

Companies have complained already . . .

. . . in a report to the Pentagon endorsed by some 48 big military contractors—GE, RCA, duPont, to name a few. Outlining the risks of government contracts, they back up their charges with case histories to prove they come out behind, dollar-wise, in doing business with the government. The report was prepared by the National Security Industrial Association composed of some 500 military contractors.

It probably won't cause major policy shifts, but it's sure to raise the ire of Pentagon brass—and of small business concerns. Covered are such complaints as contract cancellations for the convenience of the government policies, and the creation of competition —through dispersion of proprietary information to competitors.

"What is needed," the report concludes, "is a long-due revision in our thinking about defense business. A framework of principles should be accepted which will assure that the potential of American industry will work just as effectively in the defense area as it has for the nation as a whole. Private enterprise must have the opportunity to earn a return sufficient to warrant its investing personnel, facilities, and money, in government contracting.

"Then, and only then, will the government receive full value for each taxpayer dollar spent."

Small users of aluminum . . .

. . . may be in for a break. Under new government regulations, the three big producers—Kaiser, Alcoa, and Reynolds—must offer 35% of their production to small nonintegrated users instead of the previous 25%.

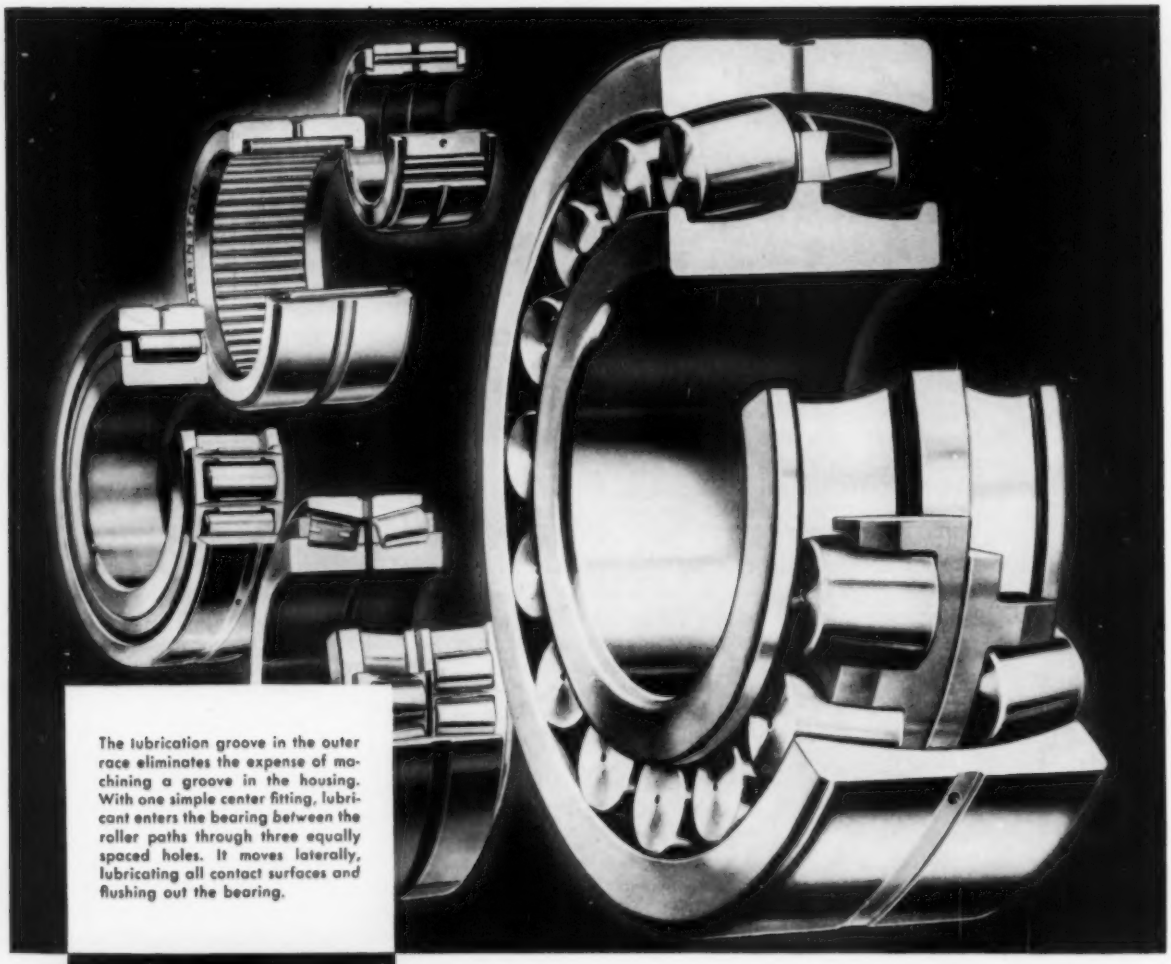
It's part of a recent, general tightening up of policy with which the government hopes to save around $98 million over the next two and a half years. It's estimated that revised contracts with the Big Three should save an estimated $3.5 million via a 1¢-per-lb price cut; other savings will result from smaller purchases.

A revision was made, too, in "put" clauses in contracts for government stockpiles. Up to now, aluminum produced in Canada was included in total production figures for determining volumes to be "put" in stockpile. Now, however, these imports must be deducted. The government will pay for its stockpiled aluminum at the delivery-time price, not at the rate of production, as has been the case.

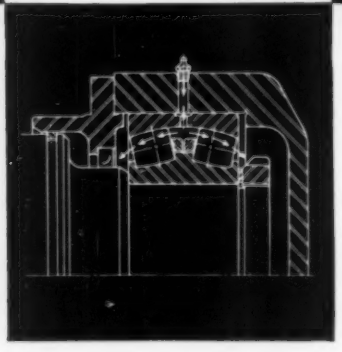
Industrial uses of radioisotopes . . .

. . . will be getting a bigger play. Prices, too, are slated to drop—cobalt-60 prices have just been cut in half by the AEC, which is the big supplier.

It predicted recently that use of isotopes will increase 10-fold by 1962, and this will mean savings to industry of as much as $5 billion annually. Already, the isotopes are reportedly accounting for annual savings of more than $400 million annually. Industrial uses have been so great that companies will not talk about them except in general terms.



The lubrication groove in the outer race eliminates the expense of machining a groove in the housing. With one simple center fitting, lubricant enters the bearing between the roller paths through three equally spaced holes. It moves laterally, lubricating all contact surfaces and flushing out the bearing.



A time-proved lubricating method now available on Torrington Spherical Roller Bearings

The circumferential groove in the outer race has met the test of experience in many Torrington Bearings, including Heavy Duty Needle Bearings, Aircraft Type Needle Bearings, Tapered and Radial Roller Bearings. Now the circumferential lubrication groove is available in Torrington Spherical Roller Bearings.

This design feature makes it possible to introduce lubricant *between* the roller paths without the expense of machining a groove in the housing. This groove is proportioned to provide generous lubricant flow capacity. Lubricant moves through the roller paths, flushing used lubricant and contaminants away from bearing contact surfaces.

Torrington Spherical Roller Bearings in many sizes may be ordered with this groove as desired at no additional cost. For further information, see your Torrington representative or write: **The Torrington Company, South Bend 21, Ind.—and Torrington, Conn.**

TORRINGTON BEARINGS

District Offices and Distributors in Principal Cities of United States and Canada

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World-wide ...

DEVELOPMENTS TO WATCH...

Free-piston generators are making big strides . . .

. . . in France and England, not only for electric-power generation, but also for locomotive and ship propulsion. Two big advantages: They operate at lower temperatures than compressor-type gas turbines, and performance is little affected by variations in ambient conditions. And in multi-unit installations, where several units feed a single turbine, one generator can be shut down for maintenance without hampering operation of any of the others.

British companies are so confident of this type of equipment that one company at least is building a series of turbines specificaly for use with free-piston generators—primarily for ship propulsion and pumping. Brush Electrical Engineering Co., Ltd., Leicestershire, has both direct-coupled and reduction-gear types in sizes from 1,000 to 10,000 hp.

Ceramic mirrors . . .

. . . of two types, fused silica coated with platinum, and polished single-crystal corundum, are used in an interesting optical device designed in France. The device, used to measure shrinkage in ceramic powders being sintered at high temperatures, is itself unusual in design. It's a longitudinal holder in which the powder compact is centered, with an alumina plate on top. Two strips of alumina lean against the plate (one on each side) to form a truncated pyramid, and the ceramic mirrors are mounted at the far ends of the alumina strips.

As the compact shrinks, and lowers, the angle changes at which the strips are resting, and, with it, the tilt of the mirrors. Beams of light reflected from the mirrors measure the angle of tilt and shrinkage of the compact.

Mirrors of fused silica coated with platinum are said to be serviceable to 1650 F. Above that (to about 2375 F), single-crystal corundum mirrors (uncoated, but with a ground surface) are used.

Continuous-cast, continuous-rolled . . .

. . . aluminum rod is being produced at the Montecatini Bolzano Works in Italy by the new Properzi system. Metal coming from the smelting furnace is fed into a V groove, closed by a steel strip, on the outer edge of a rotating plate. A stream of water cools the inside of the plate. The metal emerges as small ingots, triangular in cross-section, which are then fed directly to the rolling mill for forming.

In early trials, rod produced this way had a rather high resistivity, caused by impurities held in solid solution. Montecatini metallurgists report, however, that small amounts of boron (0.005%) neutralize the effects of these impurities and permit satisfactory metal to be produced.

An electronic balancing machine . . .

. . . of a new type that incorporates an amount meter and integrating amplifier has been designed by C. F. R. Geisler, Ltd., of London. Like other dynamic balancing machines, it has a transducer pickup unit that converts mechanical motion from the bearing carriages into an electrical signal. However, because the transducer responds to acceleration, and the indicator should respond to displacement, an integrating mechanism is needed. This is where the integrating amplifier comes in. It makes the conversion so that, Geisler says, "the pointer of the amount meter constantly indicates a figure proportional to the unbalance displacement, regardless of the speed of the rotor." Other features: a stroboscope and amplifier, a band-pass filter to eliminate extraneous vibrations.

As linings for ball mills, cyclones, . . .

. . . and worm presses, the Czechs are using fused basalt (cast and heat-treated volcanic rock). They claim to have an improved fusing and homogenizing process (fusing temperature is 2375 F) that produces a material with a specific gravity of 2.95, a hardness of 7 to 8 on the Mohr scale, "an abrasion resistance surpassed only by corundum", and a compressive strength of 4000 kg/cm².

Progress with **TITANIUM**

Giant autoclave *is divided into six inner compartments, each with a turbine impeller for agitating slurry, which contains cobalt, nickel, copper arsenic, iron and sulfuric acid, and iron-arsenic compounds. The reaction is carried out at pressures of 550-600 psi, at temperatures exceeding 400°F. The Calera Mining installation, at Garfield, Utah, was engineered by Chemical Construction Corporation.*

4TH BIRTHDAY FOR TITANIUM TURBINE

in corrosive slurry that quickly kills other metals

THIS encrusted, scale-covered turbine impeller made from Mallory-Sharon titanium is a thing of beauty to the cost-conscious Calera Mining Company. It's passing inspection after four years service in as corrosive an environment as you are likely to meet.

Calera oxidizes and leaches cobalt-arsenic-sulfide concentrates in a giant high-pressure, high-temperature autoclave. The autoclave, or pressure vessel itself is lined with acid resisting brick. But the turbines, piping, thermowells, and flange linings must be metal.

The piping, fabricated from Mallory-Sharon titanium, has seen continuous service—where alloy steels and nickel alloys failed in a matter of *hours*. Even on the hefty turbines, the longest service obtained was a *few weeks*—before titanium was fully specified for all turbine parts including fasteners. With flange linings and other parts the story is the same—titanium is the only choice from an economic standpoint.

Have *you* a corrosion headache that titanium can turn into a success story? We can help you evaluate this remarkable metal in your plant, supply engineering assistance, and deliver your sample or prototype requirements from stock. Call or write now for complete information.

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What's happening in SCIENCE

Chaos goes to work

Free radicals and plasmas are disorganized states of matter. But the work now being done with them promises more-organized knowledge of materials—and new sources of energy as well.

Plasmas are materials in gaseous form—heated to temperatures so high they become partially ionized (broken into electrically charged particles). This is the state in which matter exists in the sun—and in which nuclear reactions (both fission and fusion) may occur.

So, production of plasmas is a step toward fission power and controlled thermonuclear power. Two University of California scientists have already proposed a fission reactor using a plasma of uranium 235 or plutonium 239. It would work this way:

Compressing the gaseous plasma would start a chain reaction that, in turn, would generate a shock wave, driving the gas through a magnetic field. Because the gas itself would be partially ionized, and therefore electrically conducting, part of the energy of the gas could be transferred through the magnetic field to an external electrical circuit—producing electricity directly from atomic energy, without heat exchangers, boilers, or other auxiliaries. Such a system, these engineers believe, might achieve a thermodynamic efficiency as high as 50%, and could produce as much as 500 mw of power. Disadvantages are, of course, the high operating temperature (above 3900 K), and the difficulty of building smaller units.

Free radicals also represent disorganized and usually unstable states of matter—in this case, molecular fragments, which may or may not be ionized. Actually, free radicals are very common. Many atoms are in free-radical form—missing an electron or two—when chemicals combine. The difficulty has been capturing and preserving these free radicals—keeping them from combining—so they could be studied. Recently, ways have been found not only to do this, but also to produce them as needed.

The National Bureau of Standards is producing free radicals by passing materials (oxygen compounds, for instance) though a high-frequency electrical discharge, then capturing and "freezing" them on a surface cooled by liquid helium.

Exciting possibility: A temperature rise of just a few degrees permits the free radicals to start combining, releasing tremendous amounts of heat. This means free radicals may some day provide a new type of fuel for rocket propulsion. Several labs are already at work on this.

Reaction in reverse—Heat makes them stable

An unusual class of compounds, unstable at room temperature but stable at elevated temperatures, is being developed at the University of Uppsala in Sweden.

Reporting on his specialty, high-temperature research, Dr. Leo Brewer of the University of California says that among the compounds produced in Sweden are a group of oxides almost metallic in their properties. One of them is a molybdenum oxide, Mo_3O. This compound cannot be formed by conventional methods. If a mixture of molybdenum metal and MoO_2 is heated at a very high temperature, Mo_3O will not form because it is thermo-dynamically unstable. If the mixture is heated only slightly, the reaction won't occur, or takes place so slowly that appreciable quantities of Mo_3O cannot be made. But with heating in the temperature range just below Mo_3O's maximum temperature of existence, the compound can be formed, and will be stable.

"We do not know where this stable temperature range is for other compounds," Brewer notes. But, he says, an interesting technique has been developed that could help to discover them: Using a furnace with a sizeable temperature gradient, it should be possible to test mixtures simply by sprinkling them along a tube that ran the length of the furnace. Somewhere along the gradient, the stable temperature should be met, and microscopic or x-ray examination could discover the new compound.

Captured in the frozen state, at very low temperature, nitrogen radicals on container wall give off a blue light during discharge, then settle down to a bright green glow.

Photos at millionth of a second

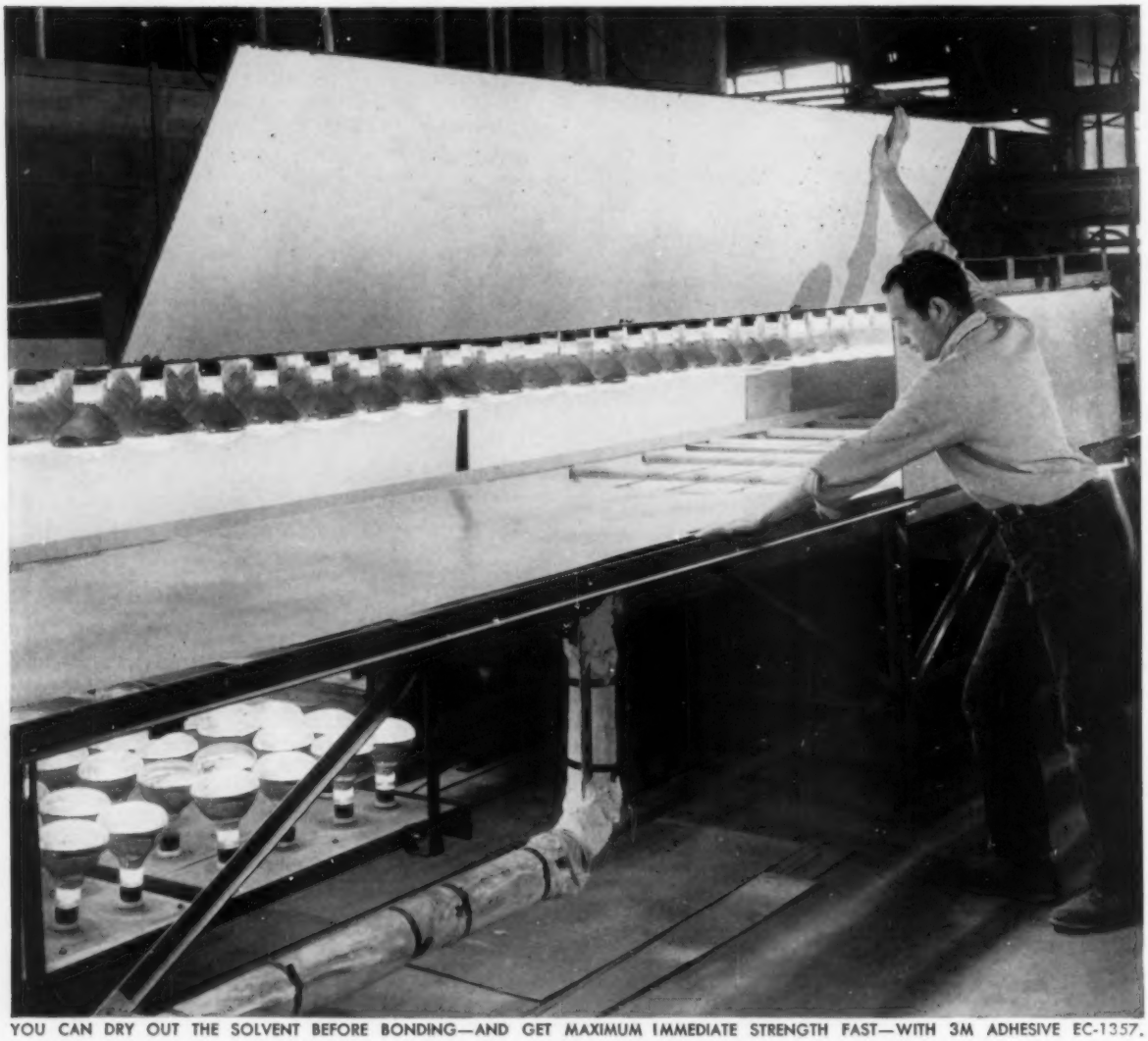
Multiframe photography with exposure times as short as one-hundred-millionth of a second will be possible with a new image converter now under development by its Electron Tube Division, says RCA.

The tube has an electrostatic focus, a grid that functions as a shutter, and a deflection system that "can produce as many as five separate screen images at a time." Developed especially for advanced engineering research (much of the work was sponsored by AEC and Army Engineers), the tube operates on a simple principle:

A fast objective lens focusses the image on the photocathode of the tube. The light striking the photocathode produces electrons that are attracted to a fluorescent screen at the opposite end of the tube. A fine-mesh grid in between controls their passage, and deflecting electrodes make it possible for the beam "to be spread out over a wide angle without serious distortion or loss of resolution."

A.R.G.

Speed high-strength sandwich bonding by predrying 3M adhesive EC-1357



YOU CAN DRY OUT THE SOLVENT BEFORE BONDING—AND GET MAXIMUM IMMEDIATE STRENGTH FAST—WITH 3M ADHESIVE EC-1357.

Here's new speed in making light, rugged sandwich panels for non-load-bearing uses!

It's EC-1357. This specially formulated, fast adhesive from the laboratories of 3M gives you high bond strength *immediately!* With infrared ovens, you can dry the solvent out of EC-1357 before bonding. Heat absorption is fast, due to EC-1357's dark color. You eliminate unnecessary drying and storage time. You need no clamps or heated presses, just cold press or nip roller. What's more, this cold bond continues to cure at room temperatures—gains added strength with age.

On metal or paper honeycomb cores, EC-1357 builds up a fillet for bigger bonding area and strength. Use EC-1357 with glass foam cores, too.

SEE WHAT 3M ADHESIVES CAN DO FOR YOU! Consult 3M Research, contact your 3M Field Engineer or write on your company letterhead for information and free literature to: 3M, Dept. 710, 417 Piquette Ave., Detroit 2, Mich.

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What's happening in MATERIALS

In metal sources, Canada leads the way

New sources of nickel, cobalt, iron ore, lithium, cesium, and rubidium are being opened in Canada, and around the world, by Canadian firms. An end to nickel shortages, for example, is promised both by new Canadian mines and opening of deposits in New Caledonia by Quebec Metallurgical Industries, Ltd. and two French combines. These deposits, says QMI, will supply cobalt as well as nickel; and a new process being developed for the New Caledonia lacteric ores may permit economical utilization of similar deposits in other parts of the world.

In iron ore, the new sources are in Newfoundland, but the push behind their development comes from West Germany. Cyrus Eaton is joining with Alfred Krupp to exploit the Ungava area, and Canadian-Javelin is working with five Ruhr companies, including Krupp, to open up the Wabash Lake range.

Lithium deposits in Canada, being tapped by Montgarry Explorations, Ltd., will also provide a new source for two rare metals, cesium and rubidium, that already have electronic applications, and may someday be used for ion propulsion. (See below.)

It will be a year or two before any large quantities of most of these metals will be available from the new sources. But they are on their way.

Cesium and rubidium for ion propulsion?

A new source of cesium and rubidium is opening up in Canada (see above)—and, with it, a host of exciting uses.

The two alkali-group metals have similar properties and are close relatives of sodium and potassium, though far less common.

Best known for its "snooperscope" application, cesium is also used in photoelectric cells, photographic and signalling devices, scintillation counters, and vapor rectifiers. But it has many other possibilities. Right now, it's one of the materials under study to fuel "ion motors" for rocket propulsion. Ion motors are by no means an accomplished fact. But they are out of the dream stage and receiving serious consideration.

In the ion motor, forward thrust would come from propelling electrically charged particles through a magnetic field. This calls for a fuel material that can be readily ionized. Cesium seems to fill the bill, and rubidium, too, is a possibility. It's similar chemically to cesium, but considerably more reactive—more so even than potassium—so it might be even more useful than cesium in ion-propulsion systems.

Neither metal is cheap. They sport price tags of $2 to $5 per gram. But as more material becomes available and refining techniques improve, the price might well come down.

briefs . . .

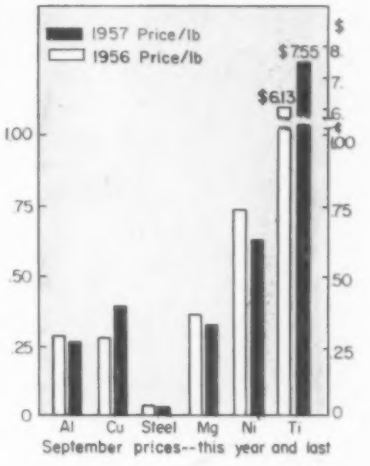
Beryllium goes into "commercial" production at Beryllium Corp.'s Hazelton plant. The AEC will take the entire output for the present; but the contract price ($47 a lb for 99% metal, compared with $71.50 for 97% metal on the commercial market) should mean good news for industry later on.

Plastics prices bear close watching. There's no established trend. While nylon and polyester film go down (see Sept. 23, p. 19), phenolics are rising. Effective Nov. 1, Bakelite will add a cent a pound to all phenolic resins—liquids and powders, as well as molding materials.

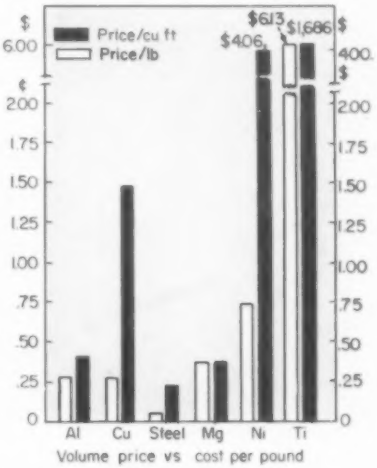
Aluminum-extrusion plant will be built by the city of Decatur, Ala. and operated by Fruehauf Trailer. It's expected to be in production—on trailer cross-members, roof rails, door components—by July, '58.

Silicon metal's growing importance in the semiconductor field is spotlighted by entry of two new suppliers: Merck and Westinghouse. A third, W. R. Grace, announced its plans a few months ago.

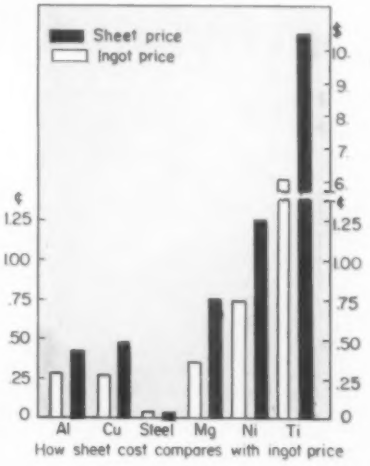
How cost patterns are changing: metals



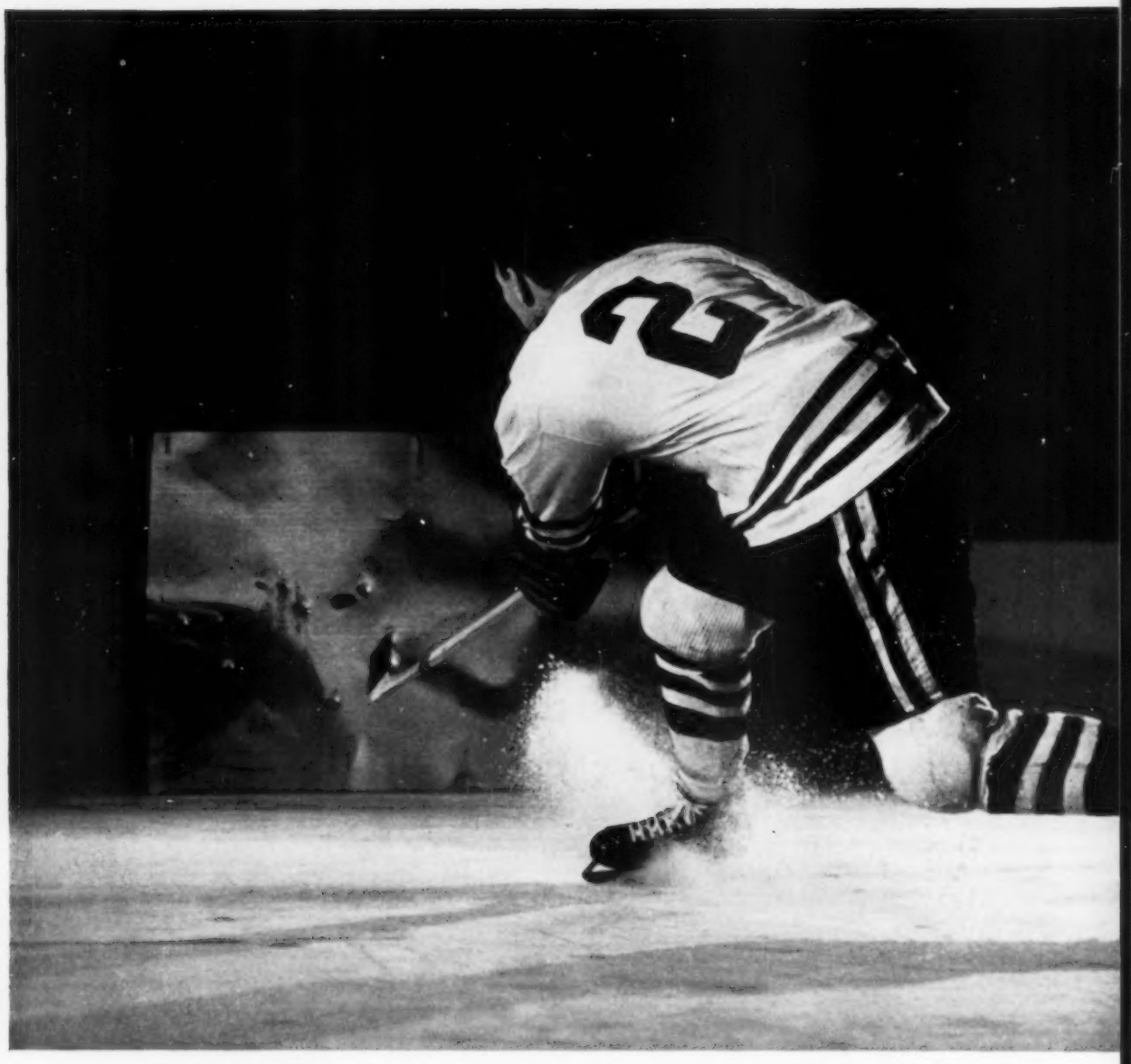
September prices--this year and last



Volume price vs cost per pound



How sheet cost compares with ingot price



BLACKHAWK ACE FAILS TO FLAKE TI-CO®

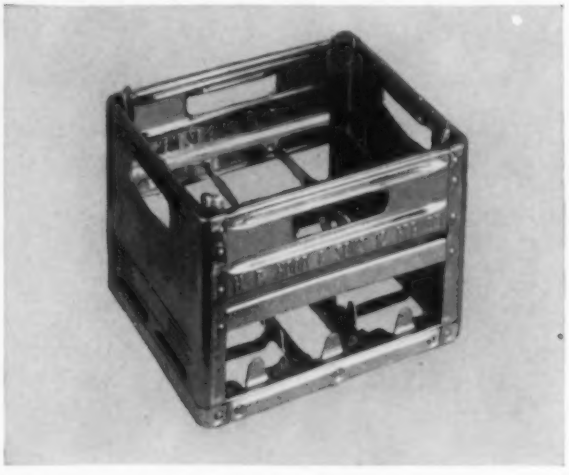
Captain Gus Mortson of the Chicago Blackhawks examines sheet of TI-CO after driving frozen puck into it. Plenty of dents but no evidence of flaking.

Gus Mortson, Captain of the famous Chicago Blackhawks, used his hardest driving shot in slamming a frozen puck into a sheet of Inland TI-CO galvanized steel. Time after time, at speeds up to 100 m.p.h., the puck banged into the sheet but the zinc coating on TI-CO stayed put . . . not a sign of flaking. This brutal test illustrates how TI-CO can take it—even when subjected to far rougher treatment than encountered in normal use. Further proof that TI-CO can withstand even the most severe fabricating operations or the toughest handling and still retain its protective zinc coating. No chance for rust to get a foothold.

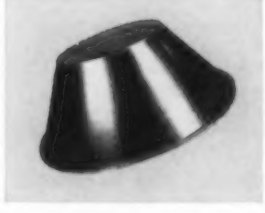
If Corrosion is a factor, consider TI-CO galvanized sheets when designing or redesigning

Before the development of the Sendzimir continuous galvanizing process, it was impractical to use galvanized sheets for many products that required severe fabricating. The zinc coating applied by the old pot-dipped method flaked excessively making costly redipping necessary.

Today, any product that can be made with cold rolled steel can be made with TI-CO. Whether it requires deep drawing, stamping, bending, crimping, lock-seaming or even spin-drawing, TI-CO takes them all in stride. The zinc coating stays put providing over-all protection against corrosion.



Milk cases must take heavy daily abuse and corrosive action of frequent contact with water during the milk cooling process. The manufacturer of this case, looking for a less expensive material than he was presently using, and one that would be stronger and still retain desired corrosion resistance, decided to try Inland TI-CO Galvanized Sheets. He was surprised and pleased to find that TI-CO performed beautifully, even when making the corner locking ears of the cases . . . a part requiring a concentrated, severe draw. In their early tests, the company subjected corner locking ears made of TI-CO to 200 hours in the salt spray cabinet. TI-CO stood the test perfectly, not a sign of corrosion.



For years the manufacturer of this hog waterer made the tank with straight sides, soldered at the joints. They needed the corrosion resistance of galvanized sheets but available pot-dipped sheets could not take the required draw of a one-piece design without excessive flaking of the zinc coating. Then they learned about Inland TI-CO. Today, they spin-draw the tanks and covers for their waterers from TI-CO. Their production costs have dropped 40% (a reduction in soldering of 30% alone). They have a product greatly improved in appearance and durability too.

TI-CO Galvanized Sheets are readily available!

The terrific demand for this high quality sheet has kept TI-CO in short supply since its development. Now, additional production facilities have been completed making greater quantities available.

TI-CO is available in cut sheets or coils, in gages 8 to 30 inclusive and widths as great as 60 inches. TI-CO comes with dry, oiled or chemically treated surfaces. Consult your Inland representative for your needs.

If you are presently manufacturing or designing a product in which corrosion is a factor, it will pay you to investigate TI-CO galvanized sheets.

Write today for a free informative booklet on TI-CO to:

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38 South Dearborn Street • Chicago 3, Illinois

Sales Offices: Chicago • Milwaukee • St. Paul • Davenport
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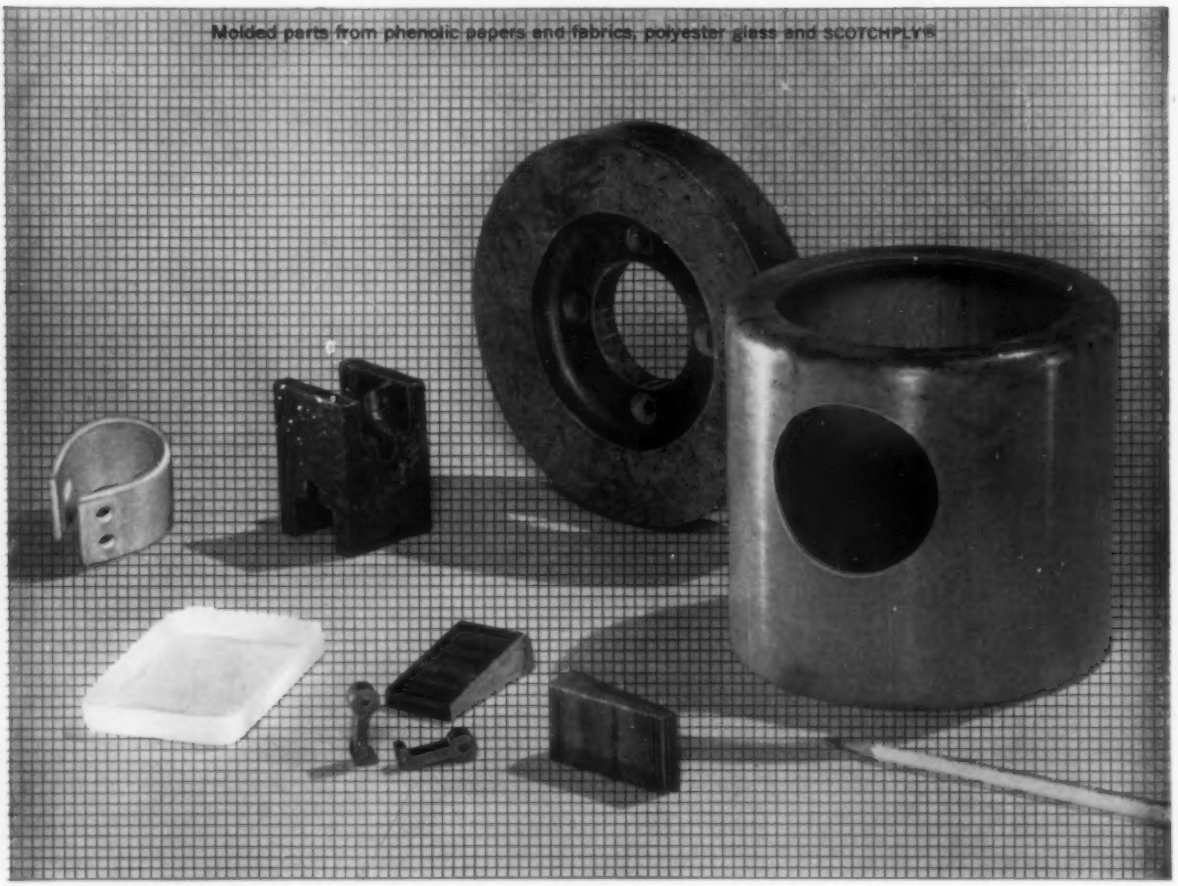

For better molded laminates...
LET MICA MOLD IT

MICA'S *greater knowledge of materials, molding know-how, ability to vary materials as required, and problem-solving abilities pay off.*

For savings, let MICA mold it. Our knowledge of base materials and molding methods, our undivided responsibility for quality of both materials and workmanship, and our specialized equipment save time and assure consistency, accuracy and prompt delivery.

For special applications, let MICA mold it. Our molding materials include LAMICOID® phenolic papers and fabrics, polyester glass and SCOTCHPLY® epoxy glass. These materials offer light weight, high strength and stability, chemical resistance, insulating properties, heat resistance and low moisture absorption. This wide range of properties meets many different application requirements.

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For creative engineering, let MICA mold it. We are prepared to apply our knowledge of base materials, molding and fabricating methods, and application experience to the design and manufacture of prototype or experimental materials and parts.

For prompt quotation on your needs, send us your prints and specifications. We can also supply machined parts from paper, linen, canvas, nylon, asbestos and fibrous glass base materials. A MICA representative will be happy to give you any engineering assistance needed.

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MICO® ELECTRICAL INSULATION

Do designers bar new ideas?

Several years ago, Timken Roller Bearing suggested to automotive engineers that if they could agree among themselves upon a drastically reduced number of types and sizes, roller bearings could be supplied at considerably reduced prices. The idea was, of course, to mass-produce a standard group. To a man, the engineers turned thumbs down. "Not until I went over their heads to company presidents, could I get a hearing," says W. E. Umstaddt, president of Timken. The result was quick agreement, and the "Bucyrus concept," (Sept. 23, '57, p. 29, & Sept. 30, '57, p. 112) was born. With it, prices are now 15% below what they'd be for the same bearing made conventionally. There's hope that it can be whittled to 25% below.

Note also that Dr. Warren A. Beck, in his article, "Select Your New Products With Care" (p. 30, this issue), says: "Beware of expert opinions, especially . . . from engineers. The trained mind is sure that it can't be done, it won't work, or people won't buy it." Several other examples of the same sort of thing have been quoted recently. Design engineers, the decisive men on product design and redesign, appear also to be too often the major stumbling blocks for new ideas. Presumably some of this resistance to change is laudable caution, but some of it also appears to be fear of upsetting the status quo.

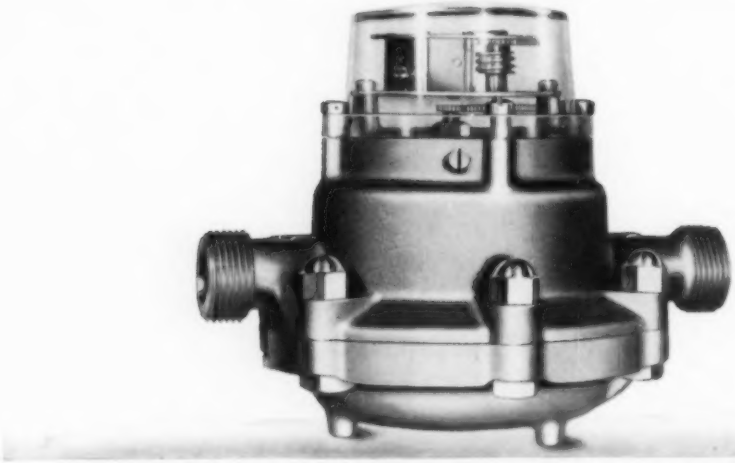
Responsibility for design of any product is not to be taken lightly. The engineer takes the rap when a product fails, whether the failure is his or not. This is a potent pressure toward conservatism. But it can also become a potent pressure toward closed-mindedness, an unwillingness to take a chance, or even to investigate outside ideas thoroughly.

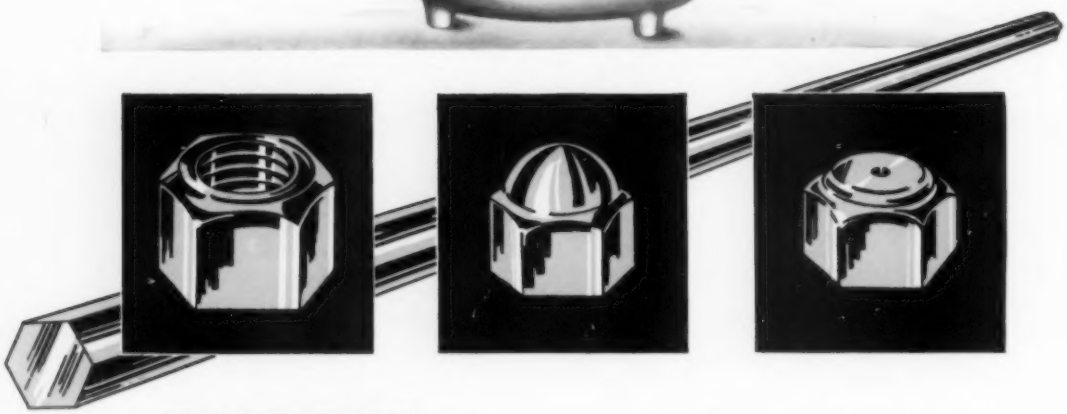
New ideas, the real "breakthroughs" in design, are the products of single brains. It is to be hoped that the brain will be in Engineering, but it may be anywhere, inside or outside the company. It is essential, however, for the engineering mind to be alert to evaluate suggestions offered, to seize upon ideas and adapt them for a new product or improvement of an existing one.

Granted that this is not easy; everybody is free with ideas, so the engineer can spend all his time examining proposals. Meanwhile, Sales is pressuring for "sales points" or design changes for special customers, Manufacturing is pushing for changes to ease production, Accounting is pushing to pare nickels.

The important thing is neither to adopt an attitude of resigned acceptance of everything, nor to adopt one of rigid resistance, but to maintain the middle ground of alertness.

They solved a "MUSHY" machining problem at Buffalo Meter Company...





with CHASE® free-cutting brass rod!

Production runs more smoothly now at the Buffalo Meter Co.—with Chase Free-Cutting Brass Rod on the job!

Though nuts seem a simple, non-critical item, Buffalo machinists complained of "mushiness" in rod formerly used to fabricate special acorn and stuffing box nuts. Thread cutting was poor; strength of finished threads less than desired.

Chase studied the problem, and by specially modifying top-grade brass rod, came up with stock superior to any yet tried. Result: *rod that stands up to tools better...gives sharper, cleaner threads.* To quote this satisfied Chase customer: "*Definitely a noticeable improvement over that of a competitor used on the same job last year.*"

Why not have a Chase trouble-shooter look in on your shop?

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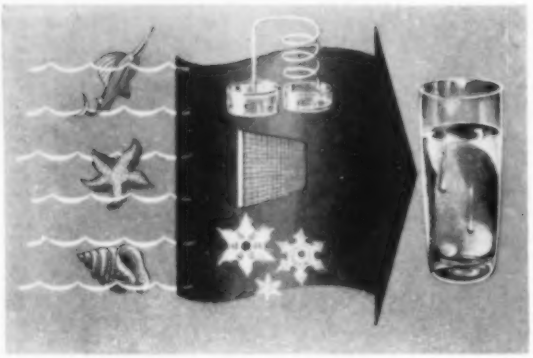


U.S. Invests Heavily In Fresh Water

WASHINGTON, D. C.–Pushed by population pressures and driven by droughts, the U. S. government has pumped $2 million into new schemes for giving the nation more water–and has plans for spending millions more. Objective is to turn salt water from the sea and water from brackish pools into fresh water for human consumption, irrigation, and industrial uses.

The money is going into researching and developing highly technical methods that employ such aids as solar power, electrolysis and electrodialysis. Spearheading the crash program is the Interior Department's Office of Saline Water (OSW) set up by Congress five years ago to finance and coordinate the research and development in the field of water purification.

Previously, the problem was to cut costs of expensive processes. But the need now overshadows the cost factor. And if successful, fresh water conversion could go down as one of the great technological breakthroughs in scientific history.

The need stems from several crises that have developed in the U. S.: droughts in the Southwest and Northeast, increased pollution of our river systems, a lowering of the water table throughout the nation. All this has made location of industrial facilities more dependent on guaranteed sources of fresh water.

Key to the government program–detailed in the chart below–is, of course, the development of efficient equipment.

Such equipment in turn depends on capital investment. That was the idea behind setting up the OSW as a pump-primer, and authorizing government scientists to spend $10 million for finding processes and equipment that industry, agriculture and municipalities could afford to use.

This summer, federal saline-water funds were cut by Congress, along with other administration budget requests for fiscal 1958. OSW asked over $1 million for a stepped-up program, but got about $600,000 for the contracts outlined in the chart.

Government officials see this year's expenditures maintaining an existing level of experimental research and development. OSW's program is assured to 1962. More than $2 million has been spent; but there is no assurance Congress will appropirate all of the remaining $8 million authorized.

The Four Leaders

Nevertheless, the Interior Department is optimistic about the progress made so far. As the chart shows, four main processes have been developed. Of these,

---

Major water projects now financed by the OSW:

I—Distillation or Vaporization

Vapor compression still—developed by W. L. Badger & Associates, Consulting Engineers, Ann Arbor Mich., is farthest along; will be tested in a million-dollar pilot plant planned for 1959. Uses long-tube vertical distillation equipment. Whiting Corp., Harvey, Ill., is tackling the problem of salt-scale deposits.

Rotary still—being developed by Badger Mfg. Co., Cambridge, Mass. (no connection with W. L. Badger). In field-test stage, this Hickman-Badger method also faces problem of salt-scale depositing in machinery.

Solar still—under study by New York University; Bjorksten Research Laboratories, Madison, Wis., and others, uses sun's energy to distill fresh water.

Nuclear energy—Fluor Corp. Ltd., Whittier, Calif., is exploring ways to harness nuclear energy to other distillation processes.

II—Membrane Filtration

Electrodialysis or the ionic process—electrically filters water through synthetic filters patterned after animal tissue (which does the best job, but is too flimsy). Ionics, Inc., developed the process, which is also being worked on by Bureau of Reclamation Labs, and numerous groups and companies in the US and abroad. Particularly good for brackish water.

Osmionic process—uses synthetic cells instead of outside electric power. Southern Research Institute, Birmingham, Ala., is investigating this. US Bureau of Standards is working on membrane filtration generally.

III—Crystallization

Flotation—separates salt or mineral content from frozen water: a project of Applied Science Laboratories, Inc., State College, Penn.

Flash evaporation—another freezing process, being researched by Griscom-Russell Co., Massillon, Ohio.

Refrigeration—a general study by Carrier Corp., Syracuse, N. Y.

Zone-purification—another freezing process developed by Battelle Memorial Institute, Columbus, Ohio.

IV—Extraction

Chemical solvent process—various chemical agents to extract fresh water, being studied by Texas Research Foundation College Station, Texas and Applied Science Laboratories, Inc.

distillation methods are the farthest along—especially the long-tube, vertical distillation still being developed by W. L. Badger. The problem with both this still and the rotary-type still being built by Badger Mfg. Co. (no relation to W. L. Badger) arises from a salt scale that slows down distillations and research is aimed at solving this problem first. The U. S. Reclamation Bureau is studying all distillation processes.

The freezing (crystallation) and membrane filtration processes show promise; so does solar distillation. These however, are in earlier development stages. The chemical solvent process is only in the warmup stage.

Comparative Costs

The big cost problem is: Water conversion costs four times or more than the cost of water from other sources such as rivers, lakes and rain watersheds. The OSW recently summed up new cost estimates on various precesses.

Sea-water conversion ranges from a low 39¢ per 1,000 gallons for a large-scale (75 million gallons daily) plant operating on the vapor-compression and multiple-effect principles developed by W. L. Badger, to $1.85 per 1,000 gal for a similar-size unit using an electric-drive vapor compression system of the Cleaver-Brooks Co., Milwaukee. Between is the Badger-Hickman rotary with an estimate of 96¢ per 1,000 gal.

The fourth process subjected to the OSW standard estimating procedure is the electric membrane demineralizer (electrodialysis). Extrapolation was made from field tests run by its developer, Ionics, Inc., on freshening brackish water with a saline content of 4,000 parts per million—a small fraction of the saltiness of sea water. The cost estimate per 1,000 gal: 41¢.

These estimates assume the availability of low-cost power—a major element in operating such water conversion equipment. Lack of large blocs of surplus power in some areas of the US—such as Texas and Arizona, which are in most need of additional water—may delay widespread use of saline water conversion techniques.

OSW has set these maximum cost targets: for converting sea water for municipal and industrial use—40¢ per 1,000 gal; for converting brackish water (of lesser salinity than sea water) for irrigation use, 12¢ per 1,000 gal. These targets are in line with generally prevailing rates for water from conventional sources and, as such, are a good measurement of what it would require to make the conversion processes competitive for large-scale use.

Industrial firms in some water-short areas already pay several times these amounts—so existing conversion equipment for saline or brackish water, treating water at upward of $400 per acre-foot, already has carved out a limited competitive market.

Industrial Designers in Demand

NEW YORK—Demand for industrial designers far exceeds supply. And independent design firms suffer most from this latest shortage of technical-professional manpower.

A spokesman for the independents is Walter P. Margulies, managing partner of Lippincott & Margulies, Inc., an industrial design leader employing more than 100 persons.

"We have hired four management consulting firms to scout designer talent in an effort to meet our personnel needs," Margulies explained. "As it stands, we must pay out-sized salaries to get even a portion of the people we require."

Describing the shortage as more acute than the much-publicized shortage of engineers and teachers, Margulies attributed the short supply of designers to the small number of schools offering effective courses.

"Ours is a relatively young profession," he said. "And only in recent years have schools for industrial design appeared. Coincident with our growth has come the great industrial need for people to create what the market will buy."

Production know-how used to dominate the economic scene, he explained, but now that technology has arrived at the repetitively progressive stage, the large companies are turning more and more to functional style and appearance, confident that the design engineer can translate these needs into manufacturing reality.

"Triple the number of design schools, and in five years the shortage will be relieved appreciably," Margulies suggested.

At Pratt Institute, Robert Kolli, head of the school's industrial design department, agreed that a shortage exists, but held that the scarcity has not yet reached serious proportions.

He explained that Pratt graduates some 40 to 50 designers annually, its maximum because of building space limitations. If the answer lies in providing more design courses, then it is up to universities like Princeton, which has an excellent architectural (a sister profession) school, to initiate an industrial design curriculum, he said.

"There are only perhaps a dozen dyed-in-the-wool industrial design schools in the country today. Most of these can't be expanded. It's up to the schools without such courses to provide them," Kolli said.

Although Margulies and Kolli estimate there are only 12 accredited schools in the US, the American Society of Industrial Design lists 25, and doubts the shortage is acute. A society spokesman said that design firms in other parts of the US are getting an adequate supply of designers, citing the automotive industry where an estimated 2,000 designers work.

Unofficial figures indicate that throughout the US there are no more than 4,000 full-fledged industrial designers. These are not to be confused with persons in a "periphery" classification—those whose efforts are only partially concerned with industrial design, whose roots are in the fields of advertising, marketing, engineering and psychology.

Both the large and the independent firms fret over the shortage, but the large company is more successful in hiring industrial design graduates. Major organizations like GM, GE and DuPont either conduct their own schools, or subsidize university courses.

Despite these measures, big companies continue to beat the brush for more industrial design talent. Finding the well-rounded industrial designer is proving difficult.

As Margulies described him, "the industrial designer must be thoroughly grounded in engineering, production, marketing, psychology and advertising, as well as being a creative and articulate artists (see page 28).

The American Society defines the industrial designer as able to plan a machine-made product that will have maximum efficiency as well as maximum acceptance.

Digital Computer Specializes In Engineering Design Problems

NEW YORK—A digital computer, designed to meet the small-scale or intermediate needs of day-to-day engineering and scientific work, is now being marketed by IBM. Called the 610 Auto-point Computer, IBM says that it can be programmed and operated by any engineer after studying an instruction manual only two hours.

Usually, engineering problems are written in a form unsuitable for direct solution by digital computers, so mathematicians and programmers have been a buffer (often overloaded) between engineer and machine. The IBM 610 enables the engineer to solve a problem in terms that are familiar to him to make use of his own experience.

Numbers are entered at a small keyboard. Arithmetical and algebraic operations are performed at the touch of a button, and answers are typed on paper or displayed on a small oscilloscope. Simultaneously, a paper tape punch records the operation so that subsequent solutions of the same type problems can be performed automatically.

IBM's new computer is a desk-side machine that can solve many problems handled by larger-scale electronic units. Data goes in on punched tape or at control panel, results are printed out by electric typewriter.

Special features include: automatic decimal-point location, rapid programming, decimal or octal arithmetic, small size, small power requirements (around 2 kw), magnetic drum memory, two tape punch and reading units, exceptional reliability. The computer is mounted on wheels and requires no air conditioning. It will lease for $1,150 a month; can be bought for $55,000.

Small Business Hears Research is Road To Riches.

WASHINGTON—"Do-It-Yourself" was the theme of the 3-day President's Conference on Technical and Distribution Research for Small Business here September 23-25. It was also the theme of President Eisenhower's informal opening talk as he pointed out that increased research would result in more equable distribution of national resources.

Some 1000 invited executives, educators and professional research advisors were present, and while the emphasis was on small business, some representatives of big business were there to pass on ideas and methods. From the wealth of information presented, a few key ideas stand out.

E. J. Tangerman, Editor of Product Engineering, was spokesman for the technical press to the group.

Arthur Motley, Deputy Conference Chairman, pointed out that of the 4,300,000 U. S. businesses last year, only 300,000 were large. Small business accounts for 65% of employment, 45% of gross sales. Recent studies show that small business is not big business in miniature—but is highly individualistic made up of men who want to run their own shows, without the disciplines of corporate life.

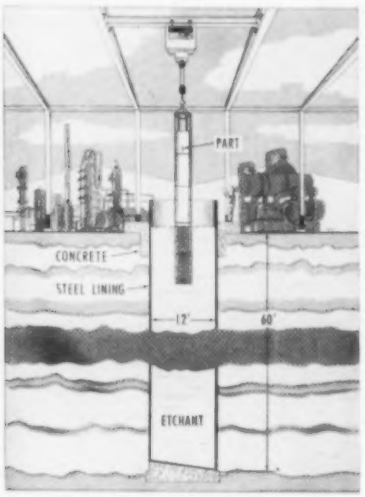
This, of itself, makes research a problem, because research requires discipline and long-term planning. The small businessman is "afraid" of research, doesn't realize he can do much on a very slim budget by exchanging ideas and by getting data from trade associations, the business press, educational institutions, government and big business.

Charles N. Kimball, President, Midwest Research Institute, Kansas City, pointed out that large business believes the major problem of small business is inadequate research and development, but that small business itself places that problem a third or fourth in importance.

J. Wilson Newman, President, Dun & Bradstreet, reported that a survey his company made among 420 businessmen indicates that all expect future growth, mostly by refinements of design rather than changes in products.

Lyle Spencer, President, Scientific Research Associates of Chicago, said there are five major barriers to R & D: failure to see its importance, high financial risk with doubtful results, too expensive, insufficient resources to capitalize on R & D that does not pay off, and lack of know-how to plan or operate an R & D setup.

New products created by large scale industrial research almost invariably create new markets, not only for the company that supported the research but for many others according to Dr. Guy Suits, research director of General Electric. He said his company alone buys materials and services from more than 42 thousand other companies most of them small.



Crane-hoisted part is lowered for immersion in giant tapering tank built by U. S. Chemical Milling Corp.

Record-size Tapering Tank Goes to Work

MANHATTAN BEACH, CALIF.—Meeting the increasing demand for long tapered structures in the design of advanced aircraft, the Manhattan Beach plant of U. S. Chemical Milling Corp. is operating the world's largest vertical tapering tank for chemical milling. Extending 60 ft underground, the tank can accomodate an aluminum wing spar 11 by 55 feet.

A wide range of immersion speeds —which control the taper angle—are possible with a specially designed hydraulic drive system that utilizes a variable displacement hydraulic motor to power the overhead hoist. Speeds vary from 0 to 120 fpm.

Eleven corrosion-resistant rings, 6 ft high and 12-ft dia, were set in the ground to form the tank shell.

Although the tank exterior was coated with a preservative before construction, additional protection is given by an anodic system—to prevent any external electrochemical reactions from eating away the shell. Four 25-lb magnesium bars are attached 90° apart on the tank exexterior. They are connected electrically, and grounded for protection. Eventually electrolysis will eat away the bars but tank surface is safe.

Inside the tank, the chemical etchant, that provides controlled removal of metal from the immersed part, serves also as a steel preservative.

Needed: More Reliable Electronic Components

WASHINGTON—One gospel that military peripatetics have been spreading this fall, as they stump the country speaking to defense contractors, is the acute need for super-reliability of electronic components.

Growing importance of reliability springs primarily from the tactics and complex weapons of modern war. The decisive phase of a conflict, so military leaders now believe, will occur during the first 30 to 60 days: a war, if one starts could be lost in the first 30 hours.

This means that at any given moment, an arsenal incorporating electronic systems must be in perfect working order to track an enemy and guide planes to the defense. Failure of a single component may impair effectiveness of the defense—explaining the high priority on reducing to almost zero the probability of electronic failure. And electronic components, so defense officials say, are far from meeting this standard.

Some indication of the problem's magnitude was outlined by E. W. Rawlings USAF Air Material Command, in a recent address before the Electronics Industries Assn. He said that Air Force studies have shown maintenance of electronic equipment is running twice as much per year as the original cost of the electronic system. And Navy stuides show maintenance costs of electronic equipment run 10 times original equipment cost.

In the Air Force, one-third of the personnel is engaged in maintenance. And one piece of complex electronic equipment has required three hours' maintenance for every hour of operation.

How can improved standards of reliability be achieved? One approach has been outlined by R. M. Barrett, Deputy Director, Electronics Research, AFCRC, at the Western Electronics Convention. He suggests that a vigorous materials research program, to develop basically new electronic components, may yield the largest payoff. Not much more, he says, can be accomplished through improved circuit design, and most of the advantages of available materials have been exhausted. Materials should be built from atoms and molecules to give the desired properties," he says.

This solar telescope was launched by balloon to a height of 80,000 ft to photograph turbulence on the sun's surface. Fundamental data derived will provide better understanding of solar atmosphere. The stratoscope weighs about 300 lb, is 9½ ft long and has a 12-in. aperture.

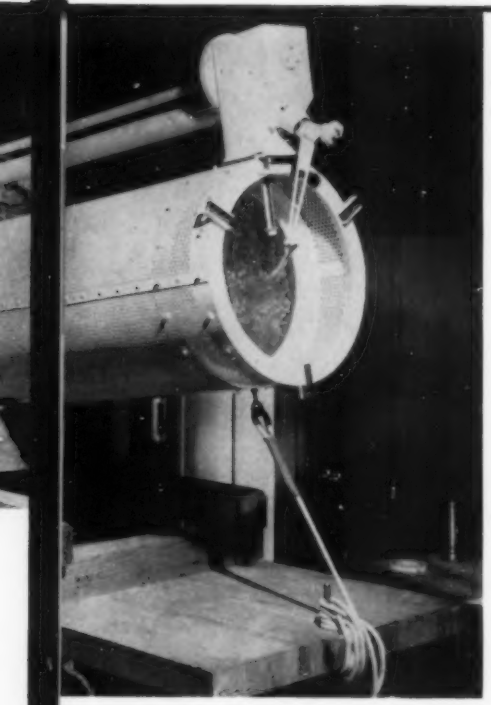
Powerful Stratoscope 3 Times Sharper

NEW BRIGHTON, MINN.—A telescope camera attached to an unmanned skyhook balloon, and sent aloft 80,000 ft to photograph turbulence on the sun's surface, markets the first of a series of such investigations being conducted for the Office of Naval Research at the General Mills Flight Center here.

This special Stratoscope telescope, designed and built by the Perkin-Elmer Corp. for Dr. Martin Schwarzchild, professor of astronomy at Princeton Univ. and chief project investigator, is a continuing phase of the program of copper atmosphere research begun by the Office of Naval Research in 1946. Other continuing projects include the skyhook (unmanned) plastic balloon flights, the Stratolab (manned) space laboratory.

Since the Stratoscope system enables the camera to take sun photographs through the telescope at an altitude above at least 90% of the earth's atmosphere, the relatively small telescope is expected to produce photographs three times clearer than any other sun photos.

Primary element of the telescope is a 12-in. aperture f/8 quartz mirror. An unusual feature is the Newtonian secondary quartz mirror mounted on a swinging arm that positions it in the sun's image only long enough to



Promises Photos Than Any Taken Before

obtain a photographic exposure. Rotating once per second, the mirror actually is "cooling" about 98% of the time. This is necessary so that the mirror will not be distorted or its aluminized coating burned off by the solar energy concentrated on it by the telescope's primary mirror.

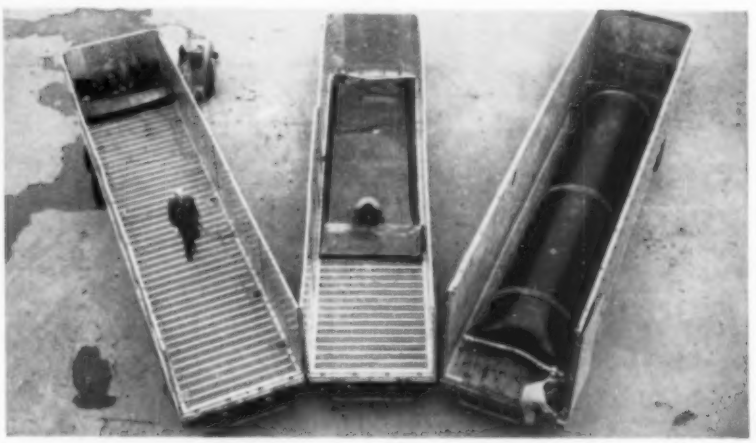
In operation, the primary image is transferred from the secondary mirror to the film plane by a relay lens working at a magnification of 25. The net effective focal length of the system is 200 ft. However, since solar energy may change the focal length of the primary optics, the relay lens is designed to move continuously so that it searches over a region of space for the correct focus. During a cycle of 20 consecutive seconds, the relay lens is in 20 different positions. The camera records all 20, but at the most only one will be in perfect focus. Thus, of the 8,000, 35 mm photographs taken in flight, approximately 400 could be usuable. One good print will answer many questions.

The solar telescope's tube is made of Invar metal, to minimize dimensional changes under the uncertain thermal conditions encountered aloft. The tube has been perforated with 40,000 small holes to permit a free circulation of air to avoid a "chimney" effect which would distort the image.

New Rubber for Pipe, Containers, Tires

WAYNE, N. J.—Among highlights featured at the opening of U. S. Rubber Company's research center here recently were four new product developments: a high-temperature rubber-plastic pipe material called Kralastic HTHT, and a rubber fabric container that may revolutionize liquid-cargo transportation (see photo); a quartet of experimental tires of the future; an improved type of butyl rubber designed for a variety of industrial applications.

According to H. E. Humphreys Jr., company president, plans are to spend a minimum of $120 million over the next five years on research at the new center and at the company's other labs at 22 locations in the US and Canada, and at plantations in the Far East. Among facilities at the Wayne research site that lend impetus to the increased research effort is a 2-million-v Van de Graaff electron accelerator that will enable scientists to learn more about the effects of atomic energy on company products.



Two-way haul-dry cargo in one direction, liquid cargo on return trip—is made possible by U. S. Rubber's "Sealdtank." The rubber-fabric container rolls into a cylindrical package only 25 in. in dia for dry-cargo transport (photo, left). Then it's unrolled (photo, center) and can hold 20 tons of liquid. The container is designed for railroad, trucking and barging industries. Tank's outer surface is neoprene for oil and weather resistance. Inner surface can be made of a variety of special rubber compounds to handle almost any type of liquid, including some highly corrosive chemicals. It can take a polyethylene liner when transporting edible liquids.

Need Definitive Shakedown, Warns ASME Head

HARTFORD, CONN. The engineering profession is "bursting at the seams and will fly apart," according to William F. Ryan, president of ASME, unless steps are taken to analyze problems facing the profession and remedy the situation (see *PE*, p 63-65, Sept. 30).

Dr. Ryan cites the medical profession as an example of good organization. Fifty years ago, Abraham Flexner surveyed the medical profession. The outcome: unexcelled technological education, a central and uniform organization, a code of ethics strictly enforced, known and accepted by all. Most important, President Ryan noted, people know who is a doctor and what a doctor does. This is something that the engineering profession lacks.

An organization chart of the engineering profession would be one of confusion, Dr. Ryan indicated. In contrast, he said, an organization chart of the medical profession is "so logical and efficient that one would suppose it had been designed by engineers." Solutions to the problem, Dr. Ryan suggests, include: defining engineering; rewriting the present code of ethics and making sure it's lived up to; investigating educational requirements.

JAMES TEAGUE
Painter, Teague & Petertil, Chicago, Ill.

The Industrial Designer—

Why are engineers suspicious of industrial designers? Many engineers have been introduced to a designer and told to work with him. They were neither consulted in advance, nor asked for opinions. Sometimes, designers were brought in at the last minute and called for extensive engineering changes.

Friction arises from a poor understanding of who does what. The engineer's primary responsibility is that the product works and can be manufactured economically, but the development process cannot stop here. The product must have sales appeal and be convenient to use. This is the industrial designer's responsibility. Management, too, has a responsibility—to establish the product's position in the over-all sales program and make sure it represents the company. Experience indicates these three activities should be the work of a management-directed team.

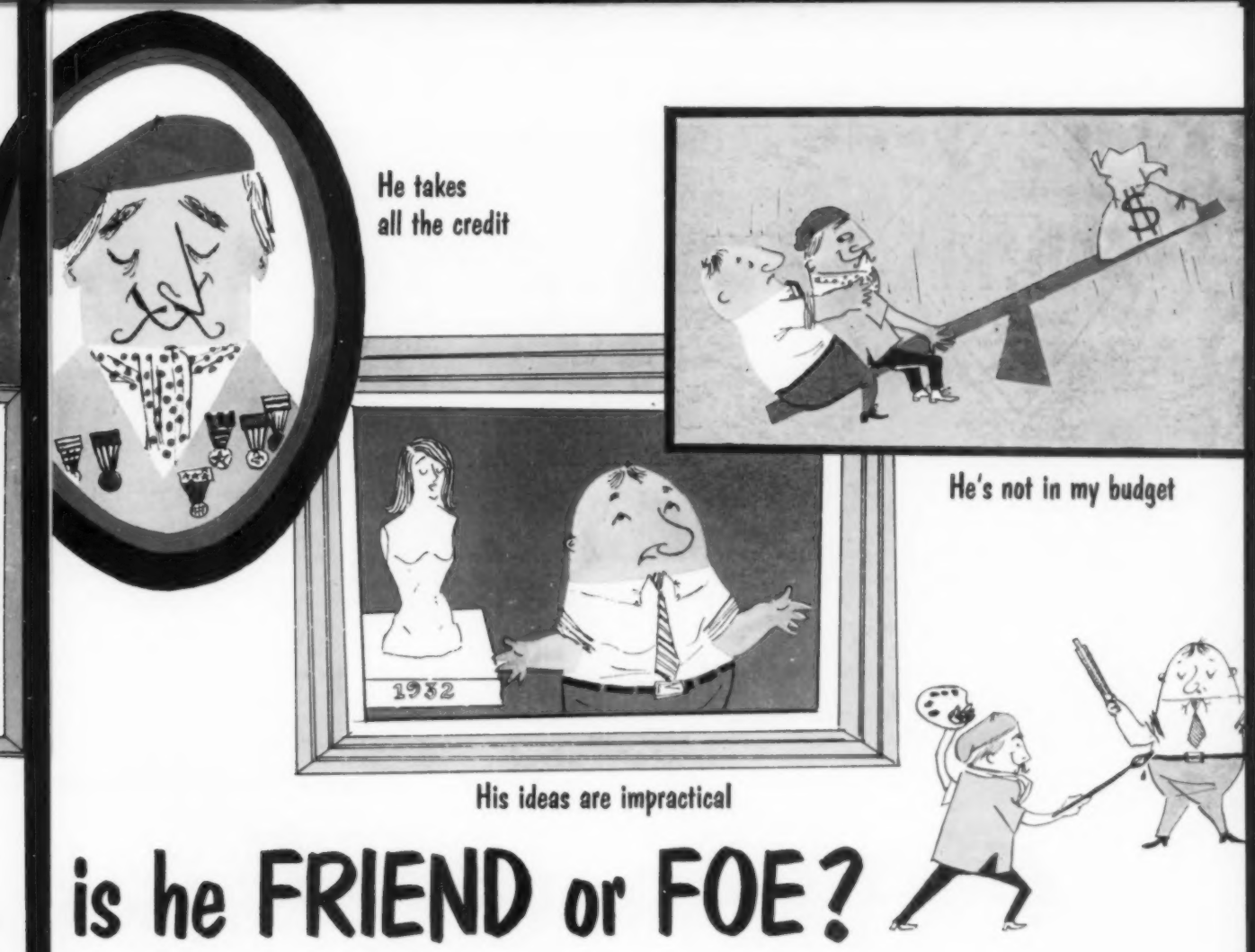
Frequently, management hires the designer, introduces him to the engineer, and lets them slug it out. A better approach is a three-member committee on which the management member makes it unnecessary for either man to go over the other's head to settle grievances. In addition, he keeps the committee headed toward its objective.

Good industrial design embodies the objectives of a company's management. This is true when new designs appear occasionally, or when they are the result of continuous development. Until a leading maker of earth-moving equipment made industrial design a management-directed activity, the various models looked as if they belonged to different manufacturers. Now top management, as well as the engineer, examines each new product from a standpoint of family resemblance and is gradually producing a line with a distinct company identity.

Effective coordination has not been established in many companies. To push the obstacles aside, engineers must understand the industrial-design challenge and accept their responsibilities in this area. This is where the rub comes in; the nature of industrial design and the conduct of design programs create situations irritating to engineers.

Theoretically, the industrial-design profession shouldn't exist. It's an offshoot of engineering. The industrial designer exists only because engineers are not trained in esthetics. Brief training in design principles is of limited value; the industrial designer's training must be as long and as thorough as the engineer's.

Too often, the industrial designer is called in after the product is designed, tested, and even scheduled for pro-



is he FRIEND or FOE?

duction. Because his suggestions cannot be adapted to the existing product, engineering changes are suggested to management. This means redesign, delayed schedules and crash programs for the engineer. He blames the designer but should blame management, instead, for not bringing the designer in at the start.

A common excuse for postponing appearance design is management's belief it may require expensive tooling for pilot models. This is not so! Designers can suggest ways to avoid exorbitant short-run costs.

Today, the industrial designer understands processes, and materials and his designs are practical. An impractical designer would put his head in a noose; his deficiency, spotted by the engineer, would be indicated to management. Reputable designers do not interfere with the functional mechanism of a suggested design; they respect the province of the engineer. However, the designer can back up suggestions with specific material and process specifications if necessary.

Recognition is important to everyone. The engineer's role in the design project should be recognized and publicly acclaimed. He is not out of line when he campaigns for his share of the credit. Whenever credits are required, a good policy is to make it a joint-credit line. "Styled by Painter, Teague & Petertil in conjunction with the Acme Co."—recognizes the engineer's contribution and is generally well-accepted.

A separate industrial design budget is required to implement any policy of continuing design evaluation. When management sets up such a budget and controls it, many cost-centered conflicts between designer and engineer are avoided. One aspect of the budget question is whether to employ a staff designer or retain an outside design firm. This choice must vary with the local situation. Firms with enough work can hire a full-time designer but should be prepared to establish him on a level with the chief engineer. Alternatively, an outside design consultant brings an independent point of view and varied experience to bear on each problem. Ω

SIX STEPS TO SUCCESSFUL DESIGN

1. **Separate appearance design and engineering functions.**
2. **Call in the designer at the start.**
3. **Put a management man on the design team.**
4. **Choose a designer known to be practical.**
5. **Recognize the engineer's contribution.**
6. **Provide a separate design budget.**

select your new product

Big companies have the facilities and financing —but how does the small manufacturer choose and guide his new product to success?

A MANUFACTURER of orchard-spraying equipment, in business since the 1890's, faced bankruptcy in 1951. Development of new insecticides during World War II made his equipment obsolete and nearly ruined him.

A manufacturer of bus bodies found himself in a cost-price squeeze between his competitors and rising manufacturing expenses. Desperate, he combed his plant, the market, and finally called in management consultants to discover some way to save the company.

The answer was the same for both—diversify, find new products. A new irrigation unit saved the manufacturer of orchard sprayers. A new delivery-truck body offered the bus manufacturer a profitable way out of the competitive bus field. He also started a subsidiary to produce seats for schools and theaters, thereby saving his bus-seat productive capacity.

Producers of all types of metal goods have seen an ever larger share of their market going to items made of plastic or rubber. Their choice is simple: Find new products or die.

Today, technological progress is so rapid that small companies may be destroyed by forces over which they have no control. Only diversification can protect the small company. In most cases, such action is essential to survival in our era of scientific achievement.

BUT HOW?

Large companies have excellent laboratory and research facilities. They have economists trained in marketing; ample financing and long-range planning give them a reasonably good chance of success (one out of five). Small companies have no such advantages, and men already busy with daily routine of production and sales rarely have time to tackle problems associated with new products.

It is, therefore, a great temptation to turn to a research agency or management consultant for advice. Such agencies have experts ready to evaluate a company and recommend suitable products based upon productive facility and sales organization. There are certainly advantages in turning this difficult task over to a group of outside experts. The search for a new product doesn't lag when company officials are busy. Also, it is always helpful to have your company equipment, finances and personnel studied by an outsider.

There are, nevertheless, many disadvantages in giving the task to an outside organization. Such service is very expensive. Minimum cost to a small company is around $5,000, and it is easy to spend $50,000 before the new product reaches the sample production stage. The small businessman who spends so much for help in selecting and evaluating a new product is frequently using too large a share of his risk capital.

Small firms will probably find it preferable to have their own staff select and evaluate the products to be introduced. Despite the seeming hazards, it is relatively easy to find a new product for consideration.

In the many excellent magazines devoted to new products, advertisements list inventors who have products they hope to sell. A manufacturer may also place such an ad himself, telling of his interest in a new product. American inventers seem to be a closely knit fraternity, and word gets around that a company is in the market for a particular type of product. Soon you will receive letters and visits from inventors referred to you by others.

A list of new products is also available from the Small Business Administration. Another interesting source of new-product contacts, not fully explored by American business, is that of foreign companies marketing items profitably in their own countries. Often they would be happy to have an American licensee.

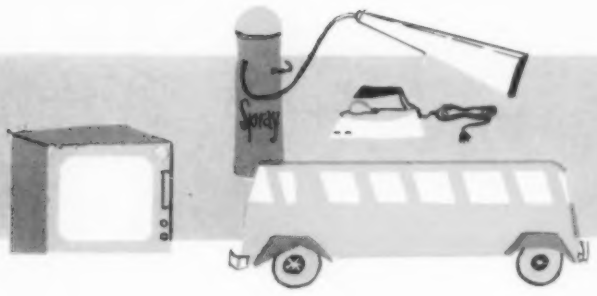
WHICH PRODUCT?

You must first decide how much risk capital you are prepared to spend. Without some idea of your possible financial commitment, it is extremely difficult to select the right item.

Next: Would it be advisable to diversify with one large product, or with several small ones? Many companies prefer to put all their risk capital in a single large item rather than take the time and trouble to develop several small items. But there are obvious merits in introducing several products; if one fails, another may have a substantial success.

Must the new product fit the productive and sales facilities you now have? Or would it be preferable to

with care...



DR. WARREN A. BECK, *Management Consultant*

take on something entirely different? You may spend more time on this problem than any other.

One manufacturer tooled a new product for the presses in his plant, only to discover that the presses weren't heavy enough and a new battery of machines had to be purchased. Another manufacturer carefully selected a household product similar to his current line. He discovered to his dismay that jobbers handling his goods weren't interested in the new items because they competed with existing lines.

It is difficult for a sales organization, established for one line, to sell similar products if new customers are required. The bus manufacturer could make theatre seats without trouble, but he had to set up an entirely new sales organization to sell them.

Despite the advantages of utilizing existing capacity, many manufacturers find entirely new products very profitable. One Midwestern company, engaged for years in job-shop foundry work, established a branch specializing in precision plastic molding. The new venture was carefully planned and it started more smoothly than had the introduction of a new line of castings some years earlier.

It may be argued that a complete change of production equipment is too expensive. But there are many dealers prepared to trade machinery, so changeovers are possible at surprisingly low cost. In addition, a company going into a new field has the advantage because of a fresh approach.

AN OPEN MIND

If selection and evaluation of a new product is to be effective, the person with primary responsibility must be sold on the need for new products and have an open, inquisitive mind. Every company has its share of doubting Thomases—"If it's good, why hasn't someone snapped it up?" If this reasoning was always followed, no new inventions would ever be put into production. Beware of expert opinions, especially your own and those of other engineers. The trained mind is likely to be sure that it can't be done, it won't work, people won't buy it. Inventors have a tendency to be eccentric, and those who select new products must be somewhat eccentric too; otherwise they tend to follow popular opinion, accomplishing nothing.

Remember to ask the inventor about competing items. A man who has spent a lot of time inventing and patenting a particular product has familiarized himself with the many similar products on the market.

If you have a product that looks interesting, a painstaking evaluation is in order. Engineering can estimate cost of production tooling. Production or Estimating can furnish a full report on the cost of manufacture. Sales can prepare estimates on advertising and promotion costs and determine market potential.

OUTSIDE HELP

Many outside sources of assistance are available to the small businessman. A good library is indispensable. There, magazines are filed that specialize in the particular field of interest. For a household specialty, a survey of the many houseware publications will acquaint you with your competition. Or if you are considering plastic-molding machinery, numerous technical publications in that field can be consulted.

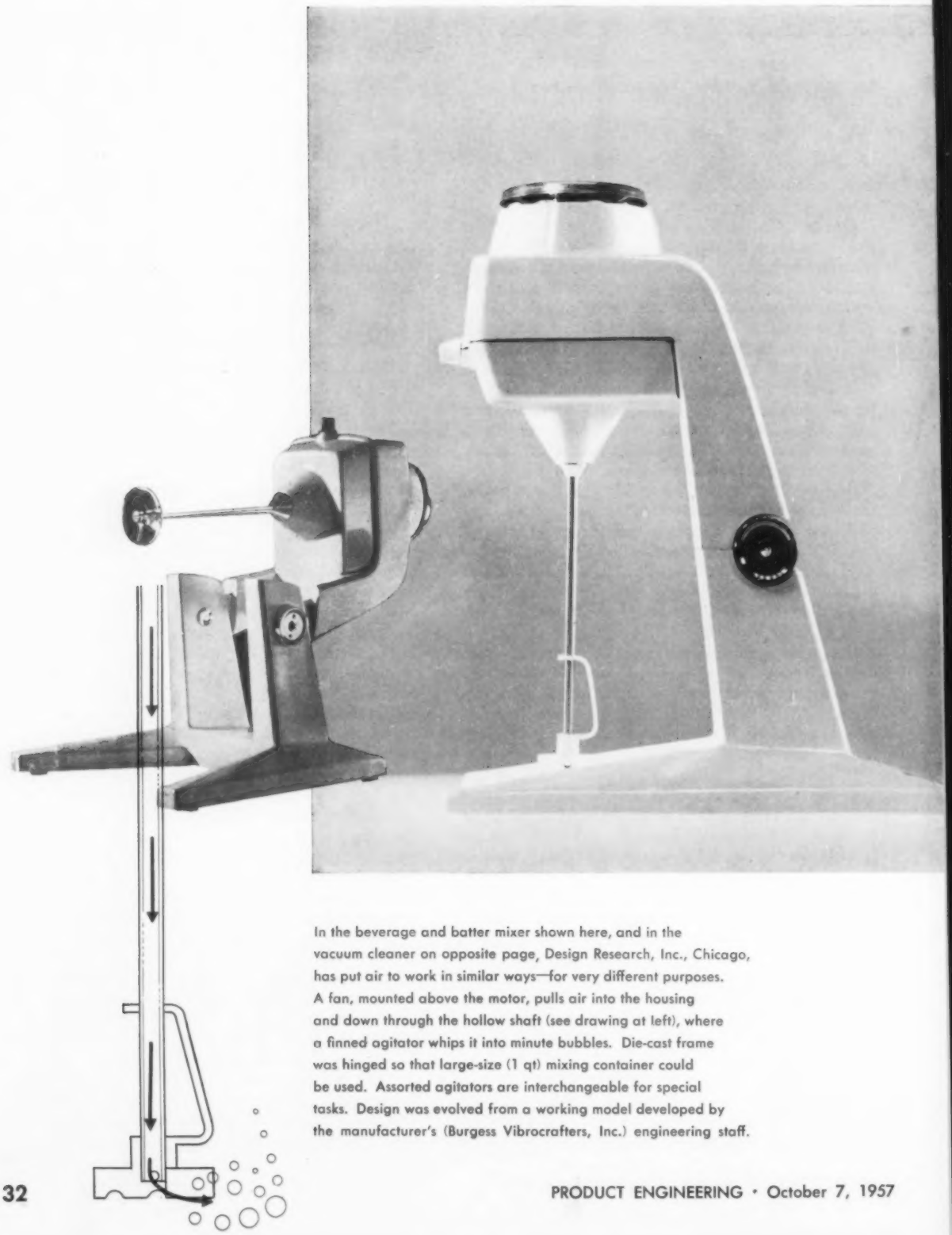
Potential purchasers are also valuable sources of market data. A visit to jobbers in the field can be most helpful. A word of caution is in order here because jobbers may be suspicious of new items, so their opinions should not be taken without reservation. One new-product specialist dealing in household items asks his wife to test his samples. After obtaining her opinion, he goes to a store to interview women making purchases of similar items. When he has finished evaluating his sample, he has a fair grasp of the sales potential.

Potential competitors in the field can also be helpful. Naturally, if the patent rights are not complete, it is necessary to be very discreet. Many manufacturers refrain from contacting competitors in the fear that the reception would not be cordial. Though you always run a risk of a blunt refusal, my experience has been that most businessmen are willing to help you, even at a risk of future competition. Your marketing program will publicize the product for them too.

On one occasion, a company was seriously considering the manufacture of four-wheel garden tractors. Visits to several garden-tractor firms showed that all were considering such activity and had information as to possible sales potential. This was readily made available and the result was a well-founded recommendation to stay out of this highly competitive field.

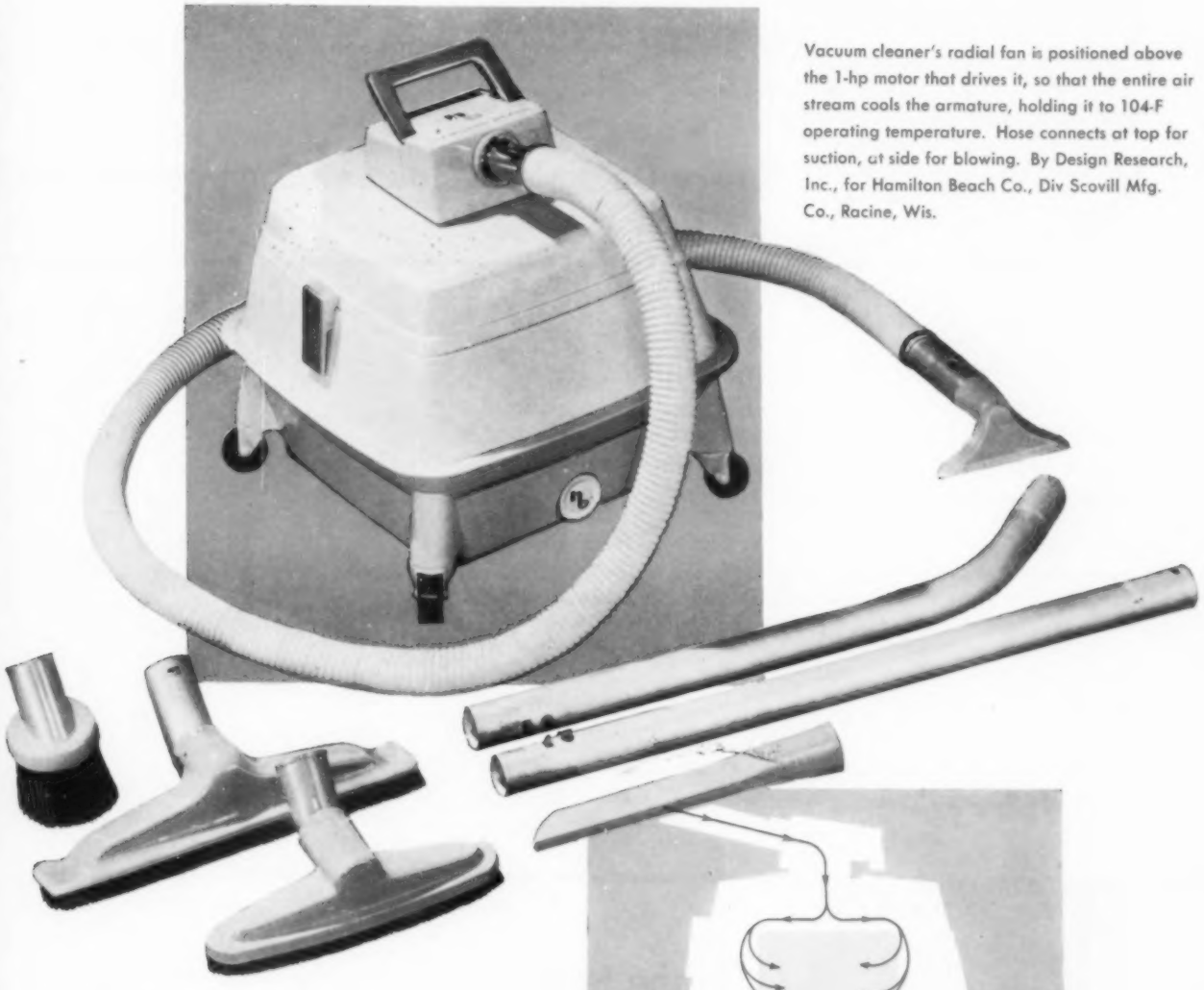
Remember that there is no such thing as a sure bet. Business is a gamble, and even the larger corporations have guessed wrong on new products. Careful selection and evaluation can substantially reduce the risk. Ω

TRENDS

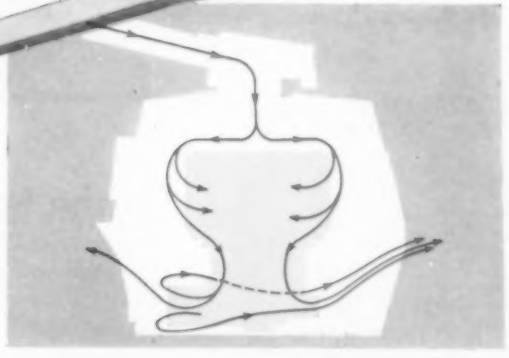


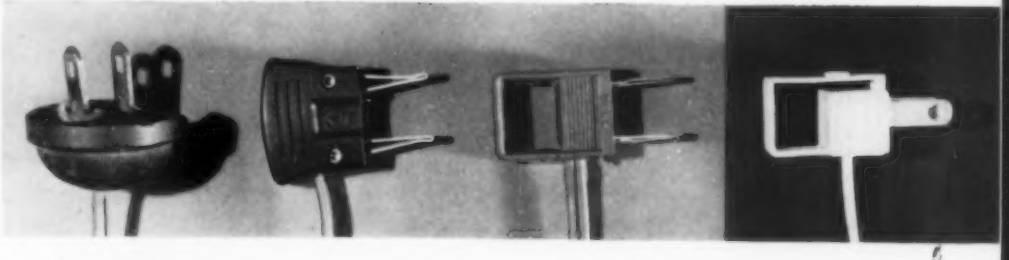
In the beverage and batter mixer shown here, and in the vacuum cleaner on opposite page, Design Research, Inc., Chicago, has put air to work in similar ways—for very different purposes. A fan, mounted above the motor, pulls air into the housing and down through the hollow shaft (see drawing at left), where a finned agitator whips it into minute bubbles. Die-cast frame was hinged so that large-size (1 qt) mixing container could be used. Assorted agitators are interchangeable for special tasks. Design was evolved from a working model developed by the manufacturer's (Burgess Vibrocrafters, Inc.) engineering staff.

in appearance design...

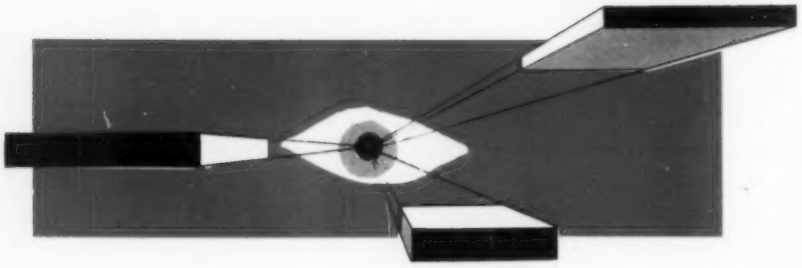


Vacuum cleaner's radial fan is positioned above the 1-hp motor that drives it, so that the entire air stream cools the armature, holding it to 104-F operating temperature. Hose connects at top for suction, at side for blowing. By Design Research, Inc., for Hamilton Beach Co., Div Scovill Mfg. Co., Racine, Wis.





Evolution of the electrical plug, left to right: 1915 model was brittle, defied pulling out, required screwing down wire ends. Insulation-piercing metal points eliminated wire stripping. Now, wire and plug assembly is entirely a factory operation. Loops on plugs at right double as finger-pulls and for stowing extra cord; manufactured by Miller Electric Co., Pawtucket, R. I.



POINTS

THE QUESTION:

How Much of What You're Doing Will You Let Competitors See?

L. E. THOMAS, JR., President
International Instruments, Inc.

"Industry has a responsibility . . .

to its customers to supply products with the best possible quality and lowest price. To discharge this responsibility, I believe the individual companies within an industry would benefit from visits to each other's plants for the purpose of interchanging technical information concerning production, quality, and reliability of their products, in keeping with requirements of antitrust laws. We also welcome and encourage visits to our plant by our customers.

"However, I believe that competition should be intense, continuous and unrelenting. Competition should be in the development of new and better products, new uses of old products, new services, and other areas that will increase the usefulness of the industry. Letting competitors know of new developments would tend to reduce competition and would not be in the best interest of our customers or of our stockholders."

ROBERT R. THALNER,
Chief Engineer
Radio and Television Div.
Sylvania Electric Products, Inc.

"In the television industry . . .

all research and product planning is done behind closed doors, with one notable exception. That is the field of product safety. Here the industry pools its information for the general good of the public. The television sets that engineers are working on today will not be introduced for another eight to 10 months so it is essential that the direction of our design thinking be classified as company secret.

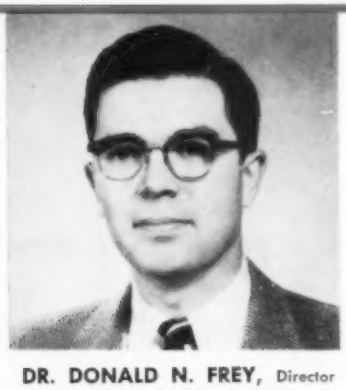
"Our industry is quick to adapt to any individual manufacturer's 'first.' A good example is Sylvania's pioneering effort in designing the first 110-degree TV set which we placed on the market last December. The 110-degree picture tube and other components were available to all manufacturers. But, the fact that we classified the direction of our planning as 'company secret' permitted Sylvania to be first with this new television concept. Without a closed-door policy, it is conceivable that Sylvania's competition could have reduced our six-month lead to six weeks or less."

OF VIEW

"A great deal of progress . . .

can be obtained by the realistic interchange of information between companies which are competitive within an industry. In any industry, individual companies benefit in almost direct ratio to the way in which the industry of which they are a part prospers. The real competition in many cases comes not from other firms in the same industry, but from the competitive materials which have been developed by other industries."

C. W. PLANJE, President
Gladding, McBean and Co.
(Ceramic & Refractory Products)



DR. DONALD N. FREY, Director
Engineering Research Office, Ford Motor Co.

"Very little!

Our success as a company is not only dependent upon year-to-year advancements in engineering and styling, but upon scoring 'firsts.' We are obliged to take every precaution to protect our new designs through every phase of their development. Therefore, many of our work areas are restricted. That is, only specified company personnel are permitted to enter. These off-limit areas include research laboratories, product engineering offices, styling studios, experimental fabricating shops, and test tracks."

"Cooperating with others . . .

through the medium of appropriate trade associations and technical societies has been the principle followed at Carrier's Unitary Equipment Div. Thus, we often disclose the results of our research and experience rather than hold such information as trade secrets, in the belief that what is good for our industry will ultimately be good for us. However, specific product developments must be protected until the particular equipment is introduced."

WILLIAM L. McGRATH,
Chief Engineer
Unitary Equipment Div., Carrier Corp.

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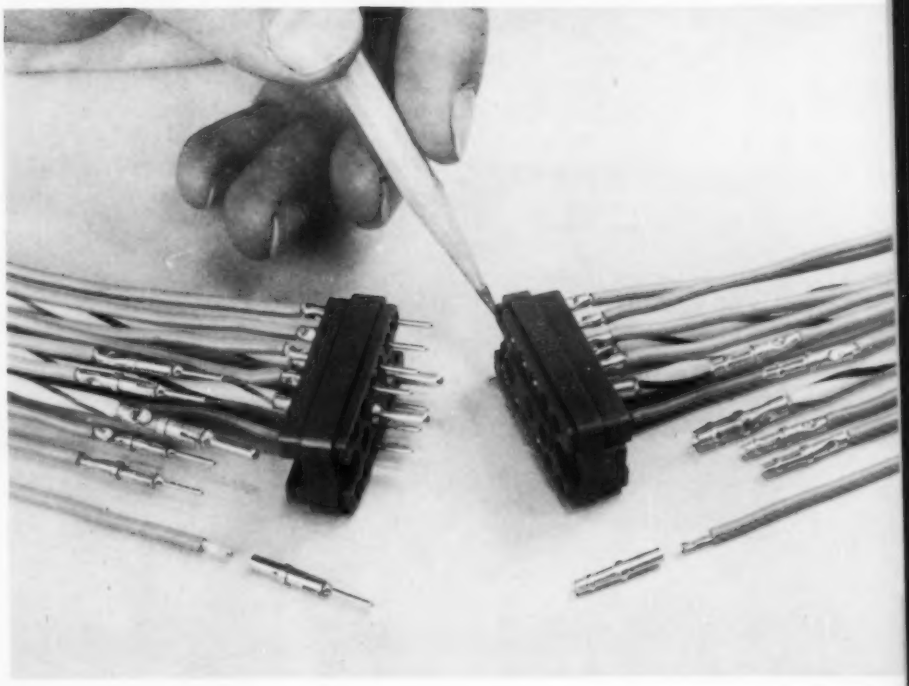
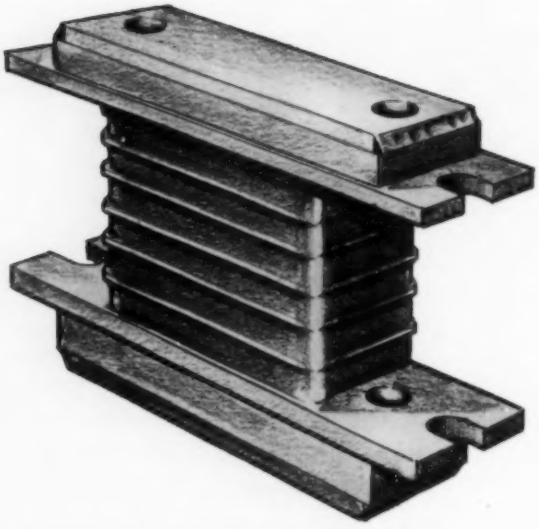
SIGNIFICANT PARTS

Solderless plugs and receptacles . . .

are crimped to wire ends with manual or automatic tools, providing connections which are reportedly more reliable because they are more easily checked. Pins and sockets snap-lock together, either before or after wiring harness is finished, and may be mated separately or in a gang connector (as shown). Available on special order now, from stock beginning January. Pricing according to individual specifications. **Burndy Corp., Norwalk, Conn.**





Shock mounting for motors . . .

originally designed for railroad traction motors consists of alternate layers of steel plate bonded to an elastomer compound. Mounting is said not to "bottom out" under high shock loads. Pre-load bolting arrangement retains unit directly under motor. Designed for static loads of 3000-4000 lb, dynamic loads of 6000 to 20,000 lb. Sample quantities available in about one month. **Lord Mfg. Co., 1635 W. 12 St., Erie, Penn.**

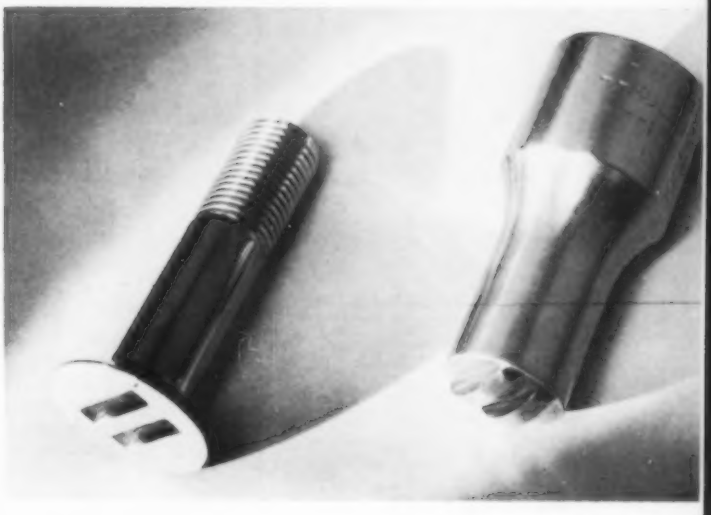
"Fusible" silicone insulating tape . . .

sticks to itself when pressure is applied, yet is not sticky to the touch. The first compound in this new series is available now in small quantities and can be extruded, calendered or molded. A second compound, electrically conductive, will be in production soon. Excellent bonds are possible with metals and fabrics. Material cost to fabricators is comparable with other silicon rubbers. **Silicones Div., Union Carbide Corp., 30 E. 42nd St., New York 17.**

MATERIALS · EQUIPMENT

Bolt with parallel driving slots . . .

is of flush-head design, and its manufacturer claims less breakage during installation and removal. Special driving tool is shown at right. Bolt is made in tool steels and a variety of special-purpose alloys, in ¼ through ⅝-in.-shank diameters. Price and delivery depends on quantities ordered. **Briles Mfg., El Segundo, Calif.**

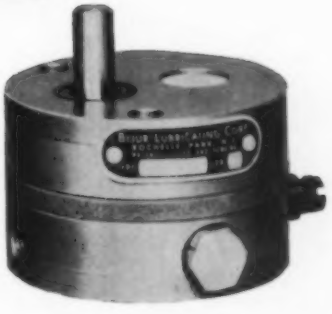


Ball bearing takes linear, rotary or combined motion . . .

and handles heavier loads than conventional antifriction equipment. Applications include arbor supports, piloting of boring bars ,and reamers. Used as an arbor support bearing, the same race-and-balls assembly can be used with a range of sleeve sizes. This bearing has been made as large as 7 in., and is available from stock in typical machine tool designs in ⅞ to 2 in. dia. Price, **$200 to $230** per bearing; sleeves, $19 to $20. **Briney Mfg. Co., Box 2208, Pontiac, Mich.**

Shaft-mounted gear pump . . .

maintains same direction of fluid flow regardless of direction of shaft rotation. This is accomplished with a transfer valve in the base of this device, which was designed for machines requiring auxiliary fluid circulation, as with automatic, recirculating lubrication systems. Built to withstand back pressures to 20 psi, a built-in relief valve prevents excessive loading. Discharge pressure is 150 psi, and discharge rate is 50 ccm at 100 rpm; recommended speed range is 20 to 500 rpm. Dimensions: 2½ x 1½ in. high. Price, about $33; delivery in about 2-3 wk. **Bijur Lubricating Corp., 151 W. Passaic St., Rochelle Park, N. J.**



SIGNIFICANT PARTS
MATERIALS
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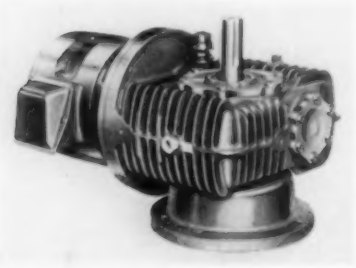
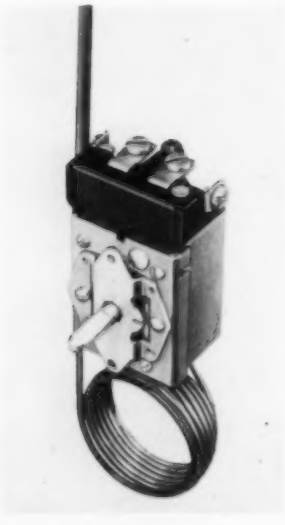


Versatile gear motors with vertical shafts . . .

mount in any position. Gear motors are double-reduction units with a helical primary and double-enveloping worm gear secondary. Worm gear meshes with a throated gear. Available to handle 1 to 15 hp, motors are standard NEMA D-flange type in 27 standard output speeds from 7.3 to 525 rpm. **Cone-Drive Gears, Div. Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12.**

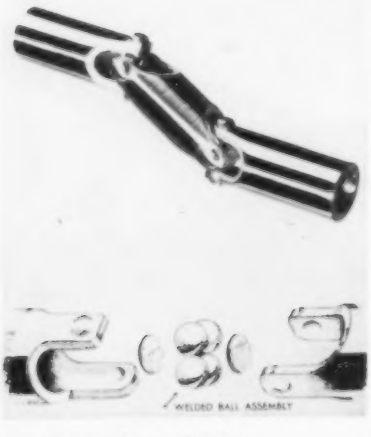


Remote-bulb double-pole thermostat . . .

for heater applications uses liquid expansion for contact activation; particularly suitable where space is limited, but high capacity is needed. Unit is 2 x 3 x 1⅞ in. Rated at 25 amp, 250 v for noninductive service, UL-approved. Contacts are snap-action, and thermal action is sensitive. Contact action is not affected by vibration. Offered in the following temperature ranges: 60 to 90 F; 40 to 100 F; 125 to 200 F; 50 to 250 F; 150 to 550 F. **Wilcolator Co., Elizabeth, N. J.**

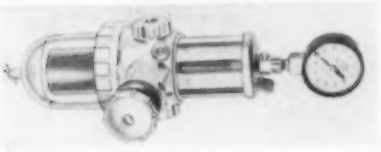
All-plastic gate valve . . .

has no-pressure drop characteristic of this design, but also provides flow-control ability of a globe valve. The cap covering the valve plug can be replaced without removing unit from line. This cap is flexible (made of Buna N, neoprene, Hypalon or Kel-F) to handle slurries as well as corrosive, high-purity materials or vacuum. Valve is PVC (to 140 F) or styrene-copolymer (to 170 F), is rated at 200-lb working pressure, and is currently available in 1 and 2-in. sizes from stock. Price of 1-in. valve under $20. **Vanton Pump & Equipment Corp., 201 Sweetland Ave., Hillside, N. J.**



Double universal joint . . .

with zero backlash effectively cancels the nonlinearity of phase relationship that exists in single joints. Preloaded bearing surfaces give continuous contact with zero backlash. Bored to shaft sizes ⅛, ¼, ⅜ and ½ in.; maximum operating angle is 60°; max torque 4 to 64 in-oz, depending on body size. Made of stainless, joint is suitable for synchros, resolvers, sub-fhp motors, indicator repeaters, potentiometers, phase shifters and similar control and instrumentation systems. **Falcon Machine & Tool Co., Inc., 209 Concord Turnpike, Cambridge 40, Mass.**



Regulator-filter-lubricator . . .

combination is ready to install and requires only two connections. Regulator operates on a balanced piston principle. At zero it serves as a shutoff valve. Pressure gage, 0 to 200 lb, is included. Cyclonic action in the filter bowl removes dirt and water. A second filtering takes place as the air passes through filter cartridge. External oil adjustment meters lubricant, which automatically enters the air stream as an oil mist. Unit comes in ¼, ⅜, ½ and ¾ in-pipe sizes. **Perfecting Service Co., 332 Atando Ave., Charlotte 6, N. C.**

Differential pressure indicator . . .

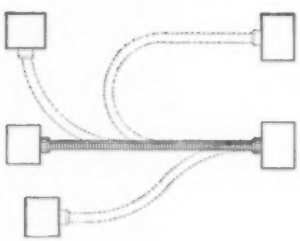
measures fast and slow transient differential pressures at any two points in a pneumatic or hydraulic system. Can also be used for short-term measurements of the difference or sum of steady pressures at any two points. The crystal-type transducer can be calibrated by conventional static methods. Pickup is used for pressure ranges to 3,000 psi, with high-pressure adaptors extending the range to 10,000 psi. Frequency range is 0 to 50,000 cps, with capacity for continuous operation at 600 F. The indicator can also be used to measure pressure or pressure rate directly. As a force transducer, with an accelerometer attachment, it is a vibration indicator that can be statically calibrated. In conjunction with simple polarized capacitor pickups, it constitutes a sensitive motion and displacement indicator. **Kistler Instrument Corp., 15 Webster St., North Tonawanda, N. Y.**

Reverse-acting electromagnetic clutches . . .

and clutch-brakes differ from other types in that input and output shafts are coupled when the coil is de-energized. When the coil is energized, the shafts uncouple and the brake is applied to the output shaft if required. This is said to conserve power in many applications. Coupling faces may be flat or with crown teeth, resulting in a wide range of torque transmission abilities. Braking surfaces are flat and rated at 8 oz-in. min torque. **Sterling Precision Corp., 34-17 Lawrence St., Flushing 54, N. Y.**

(Advertisement)

FLEXIBLE SHAFTING OFFERS NEW FREEDOM OF DESIGN



Before the innovation of Flexible Shafting, it was necessary to transmit power from a drive unit to its driven unit by means of a solid shaft which utilized expensive and cumbrous gearing. Today the Flexible Shaft alone provides a means of transferring this power from one unit to another by going around, over, and under obstacles. This allows you more space in your design, and eliminates the age old problem of having to have perfect alignment of the shaft and its drive or driven unit in order to make a connection. Flexible Shafts are simply curved towards the unit and connected by means of a ferrule, or an end fitting. If you have any application, now or in the future, which will require control from remote places, you owe it to yourself to write F. W. Stewart Corporation, 4311 Ravenswood Ave., Chicago 13, Illinois, for complete information on Circle Ess Flexible Shafting.

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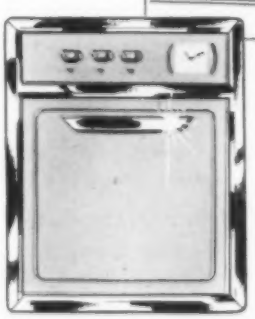

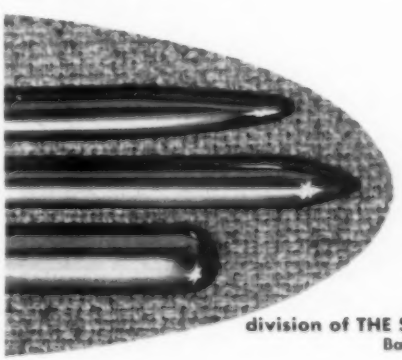

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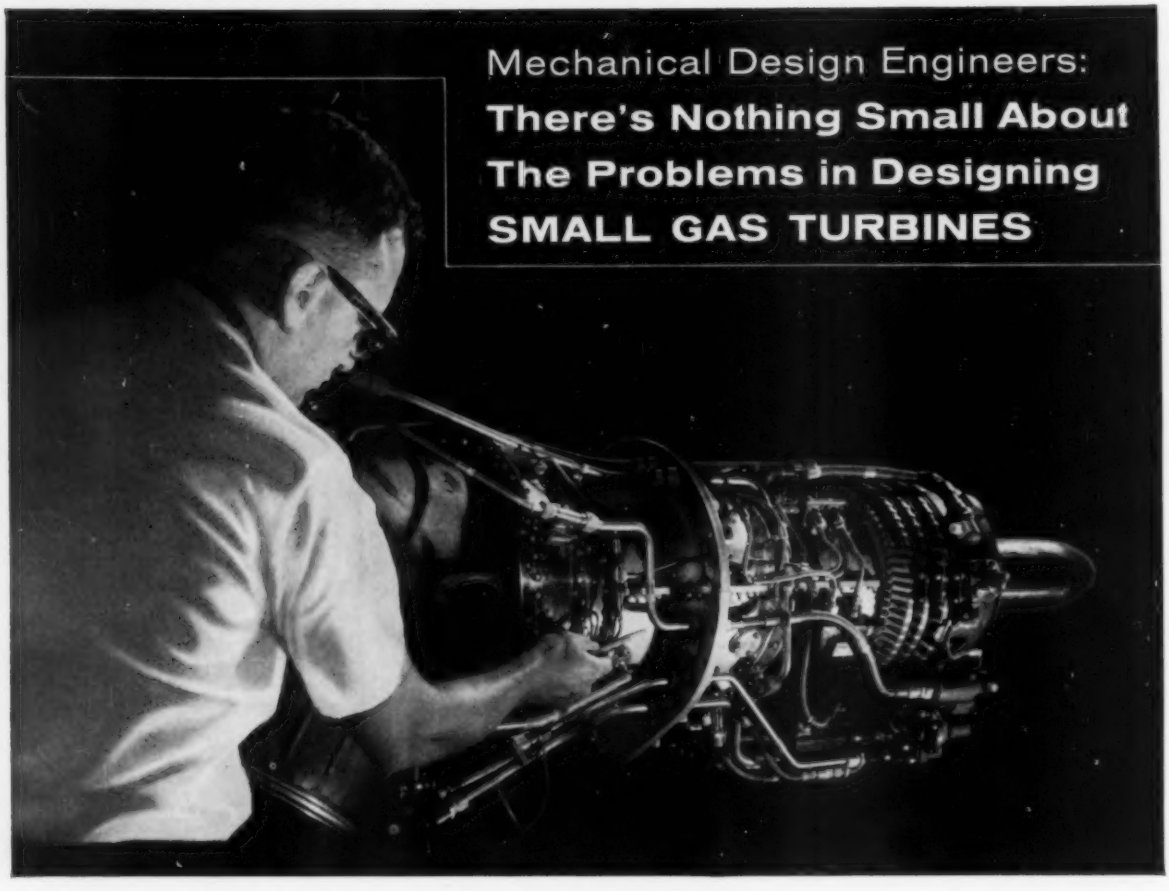
Batavia at Kilgore, Muncie, Indiana



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Some engine components — reduction gears, for example — do not scale in the same manner as the basic engine. . . . Altitude performance and flame-quenching considerations bar your way with minimum size limits to combustors and after-burners. . . . Sometimes low Reynolds numbers flatten your best ideas. Or the material thicknesses you need fall below those readily manufactured.

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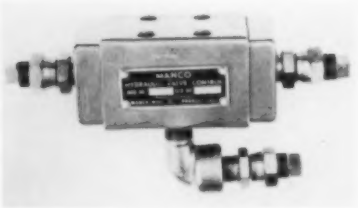
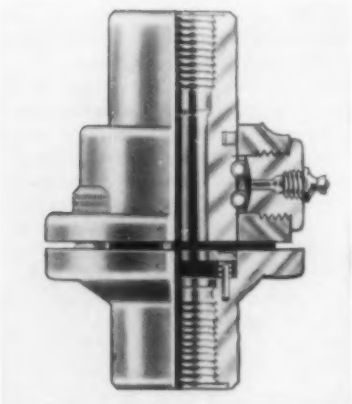


Selector valves . . .

permit operation of two or more stations from one power source at will, but not simultaneously. The automatic, hydraulically balanced, three-port selector valve is engineered for 10,000-psi hydraulic systems. Fluid enters central port and flows through both outlets until a back pressure of predetermined value is encountered. Then valve shifts automatically so that fluid flows only through outlet having the greater back pressure. Because valve seeks the line with greatest back pressure, it can be used to close automatically any line that develops a major leak. Since at least part of the hydraulic system would then remain operational, the valve can serve as a safety device. **Manco Mfg. Co., Bradley, Ill.**



Swivel joint . . .

permits packing units to be replaced without removing the unit from the line. The outer housing is cut apart at the packing chamber and both ends are flanged at the cut. This enables the joint to be parted at the packing chamber where the disk-type packing seal is located. Temperature rating is 600 F max and pressure rating is 300 psi max. Currently available in ⅜, ½, ¾ and 1-in. sizes. **Chiksan Co., Sub. Food Machinery & Chemical Corp., 330 N. Pamona Ave., Brea, Calif.**

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Allis-Chalmers Manufacturing Company requires quality, close tolerances and delivery as scheduled to maintain the fine reputation of their Construction Machinery.

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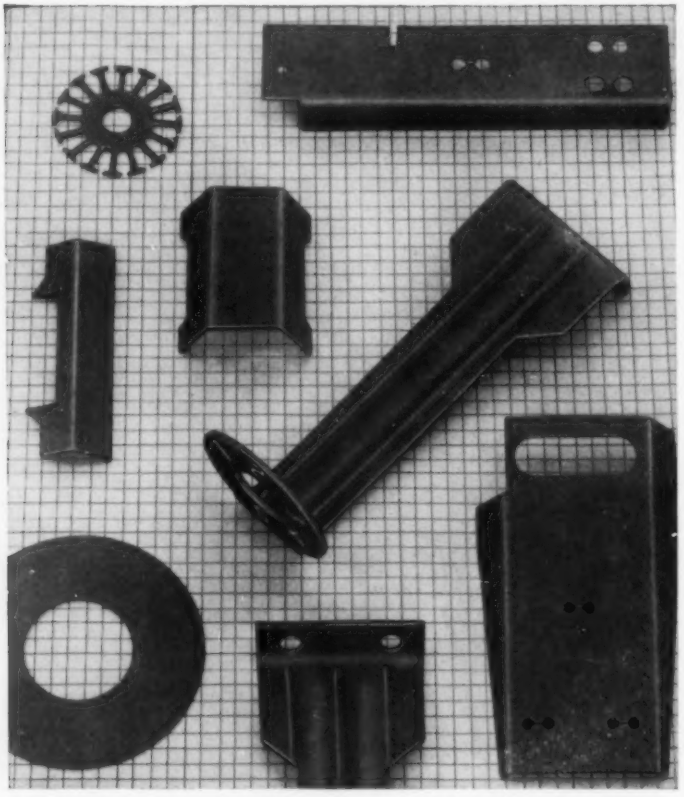
H. K. PORTER COMPANY, INC.
CONNORS STEEL DIVISION



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Weight (gr/cu. in.)	20.9	Ash (%)	0.50
Tensile (lengthwise-psi)	23000	Dielectric Strength (VPM-BD)	500
Tensile (crosswise-psi)	7000	Dielectric Strength (VPM@7%MC)	300
Flexural (lengthwise-psi)	26000	Arc Resistance (sec.)	75-100
Flexural (crosswise-psi)	15000	Rockwell Hardness (R Scale)	85
Compression Strength (psi)	41000	Oil Resistance	Good

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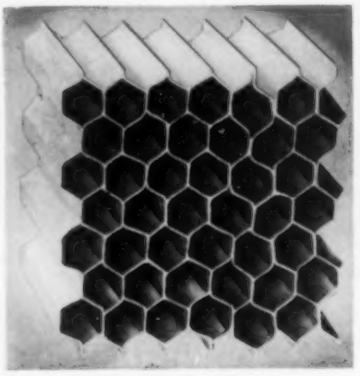


Shielded air inlets . . .

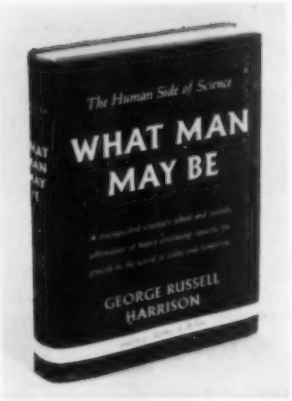
for use with all types of shielded electronic cabinetry and shielding enclosures. A minimum of about 100-db attenuation is possible up to frequencies of 10,000 mc. Available in hot-tinned dipped brass or steel in a wide variety of sizes. The company reports more efficient cooling performance than previously possible. **Shielding, Inc., Box 59, Riverton, N. J.**

Adjustable gage protector . . .

limits pressure on air or oil gages. When installed in a gage line, unit automatically cuts off flow to the gage whenever system pressure exceeds the spring setting. It re-opens automatically when pressure drops, also acts as a snubber to relieve the gage from damaging pressure fluctuations caused by fluid hammer, valve chatter, and pump pulsations. Basic design uses a spring-loaded poppet valve. Spring is manually adjustable from 50 to 300 psi or from 500 to 5000 psi. Unit is made of brass and equipped with ¼-in. NPT port connections. **Superior Pipe Specialties Co., 15201 St. Clair Ave., Cleveland 10.**

Teflon-sleeved plug valves . . .

made of stainless steel have been adapted to a bottom-entry, three-way design with screwed or flanged end. Various plug passage arrangements are available. Bottom entry gives a full-flow third port without sacrificing intraport or port-to-outside sleeve sealing. Valves are capable of replacing up to three valves plus a T-connection. Cover and plug are removable for cleaning out, permitting their use in place of an elbow connection. Available in a range of sizes and alloys. Flange and wall thicknesses meet ASA standards. **Continental Mfg. Co., 247 Park Ave., New York 17.**



NEW LITERATURE

What Man May Be

GEORGE RUSSELL HARRISON, *Dean, School of Science, MIT. Published by Wm. Morrow & Co., 425 Fourth Ave., New York 16. 278 pp, 6x8¾ in. $4.*

The acceleration of science and engineering these last few years leaves the layman bewildered—and many scientists and engineers gasping. There are those—an increasing number—who believe technology has already surpassed the understanding of all but a chosen few, and now is racing beyond control.

Dean Harrison is perhaps one of those chosen few, but unlike many, he is articulate. Here he provides a readable and understandable explanation of the whole business. Step by step, he shows the developing relationship between science and the whole man. Control of matter, of energy, of life, the body, of the earth as life's nesting place; the shaping of our senses; control of information, action and personality; faith; and finally, a projection of what man may be—these comprise the book.

Here is the answer, in simple English, to such questions as "Will the machines enslave us?" Far from being a slave to the machine, "man now has the choice as to whether he will use machines or remain . . . a slave to his poverty and hunger." To those who fear automation, he says: "Was a man who had to work 14 hours a day to afford a shack in which he could live on dark bread and soup better off than a worker . . . who by spending only half as much time . . . can have a comfortable home, a well-nourished family, and an opportunity for as much education as he and his children can absorb?" And to those who wail for the "good old days," he is not above quoting the actor who, given his choice of times, "would select the Victorian Era, but with penicillin."

He admits that there is cause for fear, but points out that fear—and consequent prudent flight—saved the atoms, the cells, the lower orders of mammals, and primitive man. It is the challenge, the crisis, that singles out the superior entity, and will continue to do so. But what of the H-bombs and their power to destroy us? Says the dean: "They have not done so yet. It is our responsibility to continue to prevent it." EJT

Man-made Fibers Compared

The two-year period since publication of the last version of this two-sided, 22-by-36½-in. chart has seen the introduction of Teflon and the new linear-type polyethylene monofilaments. These are included in this 1957 table, together with Creslan, Darlan and Zefran, not yet in commercial production. Cotton and wool continue to be listed for comparison.

Properties and characteristics described in the chart include breaking tenacity, tensile strength, breaking elongation, elastic recovery, average stiffness and toughness, specific gravity, effect of moisture, heat and various chemicals. Microscopic fiber cross-section and stress-strain curves are also provided.

Abtracted from "1957 Man-Made Fiber Table Shows Increasing Competitive Field," by W. A. B. Davidson, Associate Editor, Textile World, Sept., 1957. Copies, 1 to 15, $1 each.

U. S. Research Reactors

Prepared by Battelle Memorial Institute and published by AEC, 8½ x 11 in., 73 pp, $1.50. Order from Office of Technical Service, U. S. Dept. of Commerce, Washington 25, D. C.

Illustrated with 116 drawings, photographs, diagrams, and charts, describes more than 30 research reactors, now in operation or under construction. The reactors are grouped according to major types. One or two typical examples of each are described at length. Features of others are illustrated, and significant data given for all.

Cost information is furnished for most of the research reactors, including analysis of the relation between the initial cost of the reactor itself and total costs incurred to make it useful. A brief glossary of reactor terms is included, together with a list of research reactors built, under construction, or planned in the United States, and those intended for foreign locations

OUR ATOMIC FUTURE—Booklet, 20 pp, contains an address delivered by J. Carlton Ward, Jr., at Twelfth Annual Flight Propulsion Meeting of IAS, Cleveland, March 14, 1957. Starts with brief history of man's development of energy sources, and contains charts showing relationship of U. S. standard of living to power production, growth of research in US, government investment in atomic energy, relationship of energy requirements to fuel sources, nuclear fuels producing areas in US, world projects for atomic energy reactor construction. Vitro Corp. of America, 261 Madison Ave., New York 16.

RESIDUAL STRESSES IN COLD FINISHED STEEL BARS—Booklet, 32 pp, provides a condensed version of a paper given at the Diamond Jubilee Meeting of the ASME. Specific subjects covered range from residual stresses in cold-drawn, ground, turned, and heat-treated steels to discussions of fatigue, cracking, machinability, tolerances and corrosion, as they affect manufactured parts. La Salle Steel Co., Hammond, Ind.

SCREW MACHINE PRODUCTS—BUYING DIRECTORY, 80 pp, gives location and facilities of member companies of NSMPA. More than 275 companies are listed both alphabetically and geographically. Listing covers primary equipment, including the type and size range of machines available for contract work; types of material machined; secondary operations available; information covering the particular field or product in which the company has restricted or concentrated its manufacting operations; and any end-products also manufactured by the company. National Screw Machine Products Assn., 2860 E. 130 St., Cleveland, 20.

ELECTROFORMED TOOLS FOR PLASTICS—Brochure, 4 pp, explains how electroformed cavities are made, suggests typical uses for these molds, such as hobbing to close tolerances, very deep cavities, unusual details, irregular parting lines or cavities used for raised engraving. Electromold Corp., 290 Enterprise Ave., Trenton, N. J.

LIPPED SEALS—Booklet, 12 pp. Reference for product design and development, as well as a guide for established applications. Dept. KP13, Minnesota Rubber & Gasket Co., 3630 Wooddale Ave., Minneapolis 16.

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7-9 **ASME-ASLE Conference on Lubrication,** Royal York Hotel, Toronto, Canada. Sessions will cover recent experiments in wear, high temperature lubrication, factors affecting contact fatigue, boundary lubrication and fluid film lubricated bearings. Contact D. McDougal, ASME, 29 W. 39th St., NYC.

7-11 **American Institute of Electrical Engineers,** Fall general meeting, Hotel Morrison, Chicago, Ill. Program will include 50 sessions by the Institute's six technical divisions—Communications, General Applications, Industry, Instrumentation, Power and Science and Electronics. Subject matter will span nuclear reactors, telegraph systems, research, ethics, television and aural broadcasting, basic science, safety, computing devices, and the chemical industry.

9-11 **Society for Experimental Stress Analysis.** Annual meeting at Hotel El Cortez, San Diego, Calif. Details available from Dr. W. M. Murray, Secretary-Treasurer, Post Office Box 168, Cambridge 39, Mass.

10-11 **Society of the Plastics Industry,** New England section at the Wentworth-by-the-Sea, Portsmouth, N. H. For information contact the SPI, 250 Park Ave., NYC.

13-17 **Pressed Metal Institute.** Annual Meeting, Castle Harbor Hotel, Bermuda. Contact H. A. Daschner, 3673 Lee Road, Cleveland, Ohio.

14-18 **International Industrial Development Conference.** Fairmont Hotel, San Francisco, Calif. Conference theme is how private industry with government cooperation can increase rate of industrial development and economic growth in the free world. Further information available from Edward S. Prentice, Stanford Research Institute, Menlo Park, Calif.

16 **Society of the Plastics Industries,** Cellular Plastics Division Conference, Commodore Hotel, NYC. For information contact the SPI, 210 Park Ave., NYC.

16-18 **IRE Canadian Convention.** Technical program will include 21 sessions and 116 papers, mostly prepared by Canadian engineers. Contact C. A. Norris, Automotive Building, Exhibition Park, Toronto.

17-18 **National Conference on Industrial Hydraulics.** Sponsored by Armour Research Foundation and Illinois Institute of Technology, Hotel Sherman, Chicago, Ill. Technical sessions cover aircraft systems, automatic machine tools, mobile equipment, servomechanisms, hydraulic fluids, presses, automotive, and use of digital computers for design of hydraulic equipment. Details from Raymond D. Meade, 3300 S. Federal St., Chicago, Ill.

16-18 **American Society for Quality Control.** New England section's 11th annual conference, Stratfield Hotel, Bridgeport, Conn. Program covers phases of quality control relating to aircraft, jet power, missiles, nucleonics and ultrasonics. For information write P. O. Box 68, Greendale Station, Worcester, Mass.

17 **Society of Plastics Engineers.** Regional technical conference, Hotel Carter, Cleveland, Ohio. Conference theme: Polyethylene—Properties and Uses. Address inquiries to Mr. E. J. Haskins, Zenith Plastics Co., 3901 Superior Ave, Cleveland 14, Ohio.

17-18 **Magnesium Association,** 13th annual convention. Biltmore Hotel, NYC. Papers will cover processes and control techniques. Address inquiries at 122 East 42nd St., NYC.

18-19 **Professional Engineers of Oregon.** Conference at Eugene Hotel, Eugene, Ore. For information: Regnar Carlson, Eugene, Ore.

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Pittsburgh 22 . . . C. F. Leveroni, 1111 Oliver Bldg., Atlantic 1-4705

St. Louis 8 . . . A. E. Meanor, 3615 Olive St., Continental Bldg., Jefferson 5-4867

San Francisco 4 . . . W. C. Woolston, 68 Post St., Douglas 2-4600

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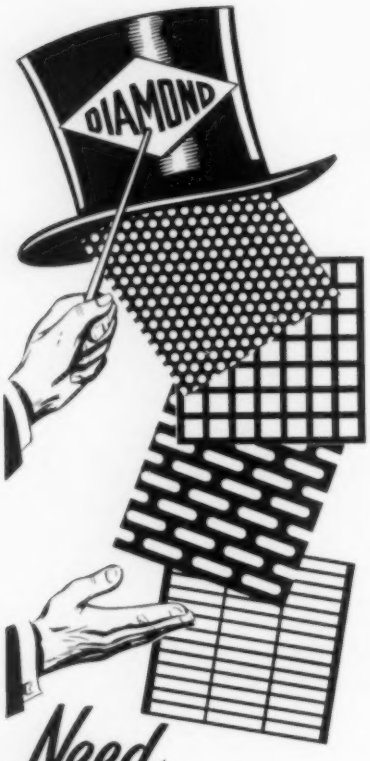
PERKINS can custom-cut a precision gear to fit your exact needs... make you a gear that guarantees full capacity and trouble-free performance. Many gear-makers promise a precision gear — Perkins delivers precision . . . always. Fifty-two years of gear-making for aircraft, automotive and instrument manufacturers assure top quality. Extensive facilities, modern equipment, rigid production and quality controls produce gears consistently uniform in tolerance with a burr-free micro finish. Perkins quality eliminates production delays and costly rejects for you . . . Perkins gears wear longer, cost you less in the long run. Ask us to quote on your next gear requirement. Then judge for yourself.

YOURS ON REQUEST Folder showing custom gears Perkins has made (from various materials) for aircraft, automotive, precision instruments, home appliances, portable and machine tools, and other products. Includes Perkins facilities for producing various gear types and sizes. *Write today.*

PERKINS
MACHINE AND GEAR CO.

Dept. 32, West Springfield, Mass.
Telephone: REpublic 7-4751



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QUICK ACTION on Perforated Metal Sheets or Parts?

We're not magicians — can't pull rush jobs out of a hat — but when quick action is needed we're usually able to ship on the specified date; or even a little sooner.

One reason is because we carry large quantities of all commonly used metal sheets and plates IN STOCK. Another reason is because we HAVE hundreds of modern tool arrangements, for a great variety of attractive perforating patterns, in a wide range of sizes. If a special pattern or layout is needed, for some particular purpose, we can MAKE the necessary tools to order.

Engineers and Designers will find all the information they need, to make a quick, acurate, selection from standard Diamond perforating patterns and sizes, in our 36-page Catalog No. 39. No charge or obligation: we're glad to send it to anyone who can use it to advantage. Estimates submitted promptly.

DIAMOND MFG. CO.
WYOMING WILKES-BARRE AREA **PA.**
West Coast Plant,
DIAMOND PERFORATED METALS CO.
17915 So. Figueroa St., Gardena, California
Los Angeles Area

Publisher's Postscript...

When advertising works for YOU

I was talking the other day with an old friend who, during the Depression, had developed a unique electrical switch. The unit was well designed, it could make or break up to 10 amperes faster, required less space than anything else on the market–and tests showed it would stand up even after a million makes and breaks. Burglar alarms, pinball games, advertising display devices–these seemed to be his market.

My friend didn't have much money to build sales acceptance or find out about its full market potentials and so he promoted sales with small ads in several publications.

In the early summer of 1938, a far-sighted advertising agency man who knew industrial markets went to my friend and said, "Why don't you tell the story of your product in detail to the men who are designing America's new and improved products"? He submitted some two-page advertisements–factual ads, well illustrated and filled with performance data, dimensions, application data, etc., and recommended the ads be placed in *Product Engineering*. After much effort he sold the idea, and the two-page ads ran every other month for a year.

When the year was up, my friend said, "I can't go on—this advertising cost is breaking me. I've gotten over 400 separate orders for two or three or six switches each, and most of the customers also want special actuating gadgets. We are losing money on every one of them. The more orders we get, the more money we lose—to say nothing about the advertising cost."

But the agency man knew that it would take time to sell design engineers. He knew that it would take still more time for them to experiment after they received samples to use, test and design for their products. Practically "on his hands and knees," he implored my friend to keep the advertising going at least till the end of 1939. Reluctantly my friend agreed, "I'm almost broke now—I might as well go completely broke."

One month later—in August—an order came from a Canadian concern for 1,000 switches of a special design (samples had been submitted nearly a year before). Later that month a New York firm ordered 600 of another design. And by December the little switch manufacturing company was not worrying about getting orders—but how to fill them.

Since those days this company has prospered almost beyond imagination. The product line has been expanded through constructive research and product development, and today it is nationally known and accepted. The product has been continuously advertised in *Product Engineering*, using factual, helpful sales messages geared to your design interests.

We mention this experience to emphasize the importance of our advertising pages. Often the products advertised offer exactly the solution you are seeking to a problem you have been trying to solve.

Last year, advertisers invested over $3 million in the advertising pages of *Product Engineering* to keep you informed about new materials, new components, and new product finishes. Nowhere else will you find so exciting and diversified an array of practical design suggestions and possible solutions.

Many companies have grown big through your acceptance of their products, and we are modestly proud of having had a part in helping introduce them to you.

A. H.

READER TO EDITOR

Metal Shortage?

To the Editor:

We regret we must call attention to an inference that might be erroneously drawn from Mr. Brandes' article on the abundance of metals (Sept. 23, '57, p. 36). That is, that magnesium is in short supply. The author's relative abundance chart is correct only as far as it goes. And it doesn't go nearly far enough with respect to the abundance of magnesium.

Even though magnesium, as Mr. Brandes indicated, is the third most abundant structural metal in the earth's crust, all but a tiny portion of the magnesium used in this country today is extracted from sea water. And, since 0.13% of every gallon of sea water is magnesium, this supply alone is certainly limitless by almost anybody's standard. To put it simply, there are about 416,000 cubic miles of magnesium in the world's oceans. Even if no more were to wash into the sea —an unlikely possibility—each of those cubic miles would last something like 60 years at present consumption rates.

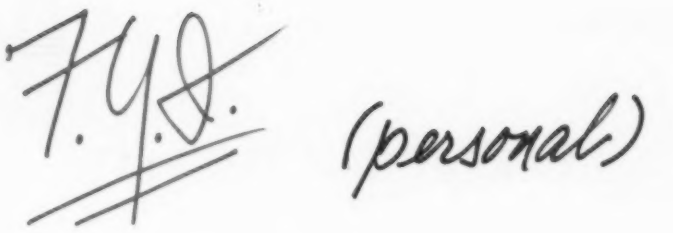
Of course, abundance is only one factor of supply. The other two are location and ease of recovery. The fact that, in theory, anyone with a coastal location, and a ready supply of lime, fresh water, sulfur, and power can begin extracting magnesium tomorrow gives the light metal a geographic importance certainly not shared by either iron or aluminum. And, the fact that sea water extraction is the most economically feasible of the several methods for recovering pure magnesium is evidence that the metal is relatively easy to recover from its most abundant source.

When you consider all three factors of availability—abundance, geographic distribution of the raw material, and ease of recovery—it is obvious that no structural metal is more readily available than magnesium.

William M. Cox
Dow Chemical Co.

To the Editor:

Of course, known reserves of copper, lead and zinc are larger today than they have been for many years. They have



"Indestructible" clothes? Coming right up!

Neither spilled soup, sprayed acid, nor the wash tub will faze next year's clothing. Coming up are new nonshrink synthetic fibers, fluorocarbon treatments for cotton and wool that can make liquids roll right off the surface, and a new type nylon to fortify cotton fabrics so they'll wear a good 70% longer than ordinary cotton cloth.

The new fibers, both belonging to the same broad nitrile family, are Dow's Zefran and B. F. Goodrich Chemical's Darlan. Zefran, newer of the two, is just now moving into test fabrics—for ties, shirts and suits. Called a "nitrile alloy" fiber, it's said to have unusually low shrinkage in washing (less than 2% in boiling water), and to hold a crease well; yet resists sticking (to a hot iron, for instance) to 490 F, and shows good wrinkle resistance and bulking qualities (warmth without weight).

It will probably be a year or two before Zefran is generally available commercially. But Darlan is going into knitted goods, and suiting materials in limited quantity will be on the market next spring.

The last note in politeness

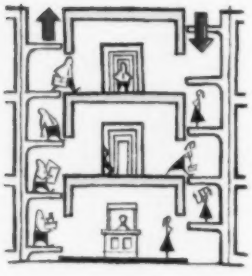
So you don't like to keep people waiting on the telephone while you look up some pertinent facts? Consider this: A music box that attaches to any telephone will play "The Blue Danube" or "Anniversary Waltz" while you're gone. Just place the receiver in the telephone cradle, and the Swiss music box goes to work. You can get it by mail order from Lewis & Conger, Mineola, N. Y. or Damar Inc., 868 Damar Building, Elizabeth, N. J. Price: $5.98.

Want to start a fire?

Whether you want to light a cigaret or fan a flame, you can do it with batteries these days—if you have a pretty penny to spend. Lewis & Conger's Mail Order Division, Mineola, N. Y., is featuring an "electronic table lighter," sparked by a flashlight battery, that's said to need filling (with ordinary lighter fluid) only once a month, and battery replacement about once a year. It has a torch-type lighter that ignites as it's pulled out of its base. Price: $15.

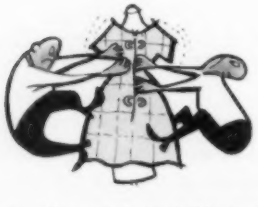
For charcoal or log fires, Abercrombie & Fitch, New York 17, and Von Lengerke & Antoine, 9 North Wabash Ave., Chicago 2, have a Quick Start Fire Blower with adjustable draft that's priced at $9.95. This one won't start the fire, but you can do that part of the job with the Insta-Light Charcoal Lighter, a pressurized fuel can with its own torch. Complete unit is $3.95; replacement fuel cans, 59¢.

WHY DON'T THEY RESEARCH and DEVELOP. . .



. . . individual elevator shafts for every floor of a tall building? They need be no more than 2 by 2 ft, with the separate up and down shafts totaling some 10 sq ft per floor. (The McGraw-Hill building has 33 floors and the 10 elevators total well over 650 sq ft. The new method would take up only some 330 sq ft—saving half the floor space.) Because only one-way traffic is handled in each shaft, platforms could be set up on a continuous-belt principle. Platforms would accelerate to top speed individually as they are picked up by a moving chain running down one shaft and up the other. Passengers could board the platforms at intervals of 1 or 2 sec and be whisked up or down without tedious waiting or interminable stops.

. . . miniature, transistorized, battery-operated radio transmitter and receiver sets to flip electric relays by remote control. Relatively crude setups of this kind are now used to open garage doors and control model planes and boats. But small sets could also be used as control stations in steel mills and foundries, in railroad cars and homes (they've recently been used for control of TV from a chair). For example, a crane operator would carry his small control box in his hand and stand at the unloading point as heavy loads are dropped into position.



. . . a clothes fastener based on the latest achievements in magnetic materials. Zippers are complex (and fallible) devices that might be replaced by two small slivers of magnet strategically sewn into mating sections. A twisting or sliding motion would have to release this invisible fastener, so some ingenuity would be required in the design. But certainly the holding power of the newer materials would suffice for any but the most severe service.

Have you a pet project but neither the time nor inclination to do the necessary R & D—Product Engineering will welcome (and identify the originator of) similar ideas based on known scientific principles but lacking an inspired manufacturer

increased despite the growing use of these metals. Improved metallurgy and mining methods make it practical to work ores of much lower metal content—and to extract more of the elements contained. I suppose eventually supplies of copper, lead and zinc will become exhausted. But certainly not in the forseeable future, and I think you'll find metal men little worried about finding substitutes for these materials because of expected lack of supply.

JACKSON HOW
American Smelting & Refining Co.

Brocot's Tables

To the Editor:

In the Sept. 16 issue (p 209) you state that Brocot references are obscure. To pay full respect to a fellow's labors, I cannot pass without observing that our contemporary, Earl Buckingham, in his *Manual of Gear Design* (Industrial Press, 1935, 3 vols) publishes Brocot's Tables, which have proved of inestimable value to me.

CHAS. F. VAN HOOK
The Watson Machine Co.

Women Engineers

To the Editor:

In your recent editorial, "Are We Short of Engineers?" (Sept. 23, p. 23) you convincingly state that we are trailing Russia in turning out engineers. You also state, "We need to do more now." This is well said, but what can we do?

I think one of your suggestions is valid—encourage the woman to consider engineering as a profession. Very few women's colleges give a girl much opportunity to take an engineering course. They give courses in physics and calculus, but mechanical drawing, thermodynamics, strength of materials, etc. are still associated with masculinity and avoided by any co-ed who believes a woman's future is best achieved with a strict liberal arts background.

It won't be easy to convince Vassar, Smith, and Wellesley freshmen that they have a future in engineering. It's an even harder task when men consider the woman engineer a violator of man's hallowed ground.

B. E. SAND
Bayside, L. I., N. Y.

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Plan a new line? Wish to upgrade a present line? Want to diversify? Investigate GREX! For full details, complete and mail the coupon.

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225 Allwood Road, Clifton, New Jersey

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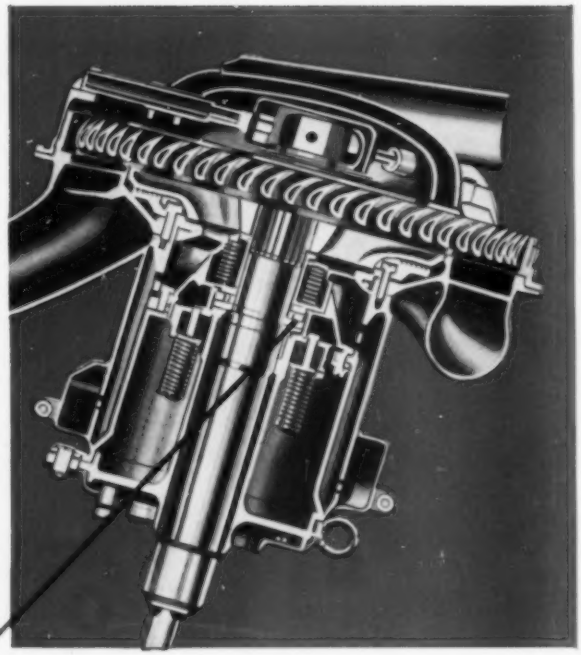
GRAPHITAR® OIL SEALS PLAY

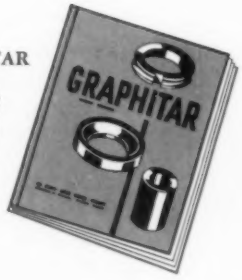
IMPORTANT PART IN DEPENDABLE PERFORMANCE OF NEW POWERFUL CURTISS-WRIGHT TURBO COMPOUND ENGINES

Increased demands for faster non-stop service has placed great demands on the engines that power modern airliners. Helping to meet this need is the powerful EA Series Turbo Compound engines built by the Wright Aeronautical Division of the Curtiss-Wright Corporation, Wood-Ridge, New Jersey. In each of these 18-cylinder giant engines, 3 GRAPHITAR oil seals play an important part in maintaining the dependability, efficiency and power. Three power-recovery units are employed on the Turbo Compound to utilize normally wasted exhaust gases and provide still additional thrust. The GRAPHITAR seals are used on the turbine shaft in each of these units and must withstand continuous high speeds and high temperatures. These seals prevent hot gases from reaching the shaft bearings and carbonizing the lubricant. Low coefficient of friction, and the excellent wear and sealing properties of GRAPHITAR make it ideally suited for this demanding installation.

Compacted under extreme pressure, and fused at heats to 4500° F., GRAPHITAR can be formed into relatively complex shapes, ground to tolerances as close as .0005". Since it is entirely self-lubricating, GRAPHITAR can be used where only steam or water are present. GRAPHITAR is lightweight, durable, chemically inert and virtually unaffected by extremes of vibration, pressure, or temperature.



Get the fact-filled GRAPHITAR engineering Bulletin No. 20. Write today for your copy. If you have design questions on problems, our engineering staff will be happy to assist you in any way possible.



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DIVISION OF THE WICKES CORPORATION, SAGINAW 1, MICHIGAN

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